ABSTRACTS FOR POSTER SESSIONS

(Arranged in alphabetical order by field and presenter's last name)

- Chemistry
- Electronics
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- Geosciences
- Life Science
- Mathematics
- Physics

Chemistry

[Chemistry-01]
Acevedo-Acevedo, Debora, UPR-MAYAGUEZ; Meléndez, Enrique, Chemistry, UPR-Mayaguez; Martínez, Melissa, Biology, UPR-Mayaguez

BHK-21 cells transfected with full lenght human transferrin

Transferrin (Tf) is an 80 kDa glycoprotein present in blood plasma which has the ability to carry two iron molecules in the ferric form (Fe^{+3}). Recently, it has been found that this protein binds to organometallic complexes. Some metallocene dihalides have shown activity on a wide variety of murine and human tumors. In order to study the antitumoral activity of metallocene complexes and their relation with Tf, this protein was expressed using BHK-21 cell and labeled with C^{13}. After the expression, this protein was concentrated, filtrated and purified using an FPLC system and characterized using UV-Vis spectrum. Once purified, the protein will be studied by NMR in order to characterize and observe the interactions between Tf and organometallic complexes.

[Chemistry-02]
Arroyo, Lisandra, UPR-RIO PIEDRAS; Raptis, Raphael; Cabrera, Carlos R., Chemistry Dept, UPR Rio Piedras

Characterization of CoPd2(Me2Ipz)4Cl4 Molecular Precursors and Development of Nanostructures on HOPG Surface

The common catalysts are easily poisoned and expensive, so a lot of research has been going into maximizing the catalytic properties of other metals by shrinking them to nanoparticles in the hope that will be an efficient and economic alternative. Our group has been working in molecular precursors and nanoparticles characterization on highly ordered pyrolytic graphite (HOPG) surfaces. This research focuses on the development of palladium-cobalt nanostructure with defined size and composition distribution which can be controlled by thermal reduction, and support chemical structure conditions. In this work, we describe the study of deposition and reductive decomposition of the heterobimetallic molecular precursor CoPd2(Me2Ipz)4Cl4 on the surface of a solid support -- HOPG. Nanoparticles of the CoPd2(Me2Ipz)4Cl4 complex were imaged by atomic force microscopy (AFM) in organized circular structures on HOPG surface. The CoPd2(Me2Ipz)4Cl4-precursor was thermally reduced under hydrogen atmosphere, a procedure which removes the organic ligads, forming bimetallic nanoparticles. We observe in the AFM images a particles formation tendency after reduction process of CoPd2(Me2Ipz)4Cl4-precursor on HOPG surface. The Co/Pd-nanoparticles were characterized by cyclic voltammetry and

surface analysis techniques. The composition of the CoPd2(Me2Ipz)4Cl4- precursor and the nanoparticles described was characterized by X-ray photoelectron spectroscopy (XPS). These nanostructures show different size distribution in the surface of the HOPG allowing its development for diverse applications. These nanomaterials have applications in different areas, such as: electronics, sensors, fuel cell and catalysis.

[Chemistry-03]
Aviles, Edward, UPR-RIO PIEDRAS; Lyda La Torre, Chemistry Department , UPR- Rio Piedras; Carlos Cabrera, Chemistry Department , UPR- Rio Piedras

Electrophoretic Preparation And Characterization Of Molibdenum Electrode With Diamond Nanoparticles

Diamond nanoparticles are distinguished by been highly stable and resistant under extremes chemical and physical conditions. Our research focused on the characterization of diamond nanoparticles in molybdenum electrode to study its topography and morphology. These investigations are important for electrochemistry studies because doped nanoparticles can be used to support and store lithium ions on an anode of a rechargeable battery. After been purified, diamond nanoparticles were deposited on small plates made of molybdenum in a process called electrophoretic deposition. It consists in applying voltage to a solution that contains diamond powder, previously sonicated to ensure homogeneity. This voltage makes charged particle to be deposited in the electrode by electrostatic interactions. Once deposited, it was characterized using a scanning electron microscope. Through this microscope we study different thickness of the deposited diamond nanoparticles after changing concentration of diamond powder from 0.1% w/v to 0.5% w/v at a constant voltage of 260 V. At each concentration we also vary time from a range of 30s to 35s to study the effects of time on thickness. The importance of characterize the thickness is to maximize the conditions that are required, like concentration and time, to obtained an ideal diamond film.

[Chemistry-04]
BALAGUERA, MARCIA, UPR-MAYAGUEZ; Marcia del Rocio Balaguera Gelves, Oscar Perales Perez; Luis Rivera Montalvo, Thomar Maharah

Synthesis and Optical Characterization of Cadmium Selenide, Zinc Sulfide and Cadmium Sulfide Chalcogenoides Nanocrystals

Considerable studies have been conducted to enhance the imaging quality of living cells. The most commonly used visualization tool is fluorescent markers. However, conventional labels such as organic fluorescent dyes or green fluorescent proteins (GFP), lack the photo-stability to allow the tracking of cellular events that happen over a period from minutes to days [1]. In this regard, semiconductor nanocrystals exhibiting enhanced photoluminescence can be

considered as promising materials for biological markers. Accordingly, the present research addresses the syntheses of CdSe, ZnS and CdS nanocrystals through a two-phase approach. This synthesis route involves aqueous synthesis and crystal stabilization in a non-polar solvent. Research efforts were focused on the determination of synthesis conditions leading to optimum photochemical performance of selected calcogenides, not only as a function of chemical composition but also of variation in crystal size. UV-Vis and PL measurements confirmed the formation of crystalline and highly monodisperse clusters in the size range between 1.5 and 5 nm.

[Chemistry-05]

Calderon, Eric, UPR-MAYAGUEZ; Peres Orcar, Ciencias de Ingeniería y Materiales UPRM; Gutierez Gustavo, Ingenieria Mecanica UPRM

Synthesis And Characterization Of Mn Zn Ferrites For Magnetocaloric Applications

There are presently many applications using nanofluids in thermal engineering. Some examples include the use of nanoparticles in conventional coolants to enhance heat transfer rate by increasing its thermal conductivity. Other applications include the sealing of bearing cases and sealing of rotary shafts. Even at low weight concentration, thermal conductivity increases significantly. In biotechnology, magnetic nanoparticles have been proposed for thermal treatment of tumor using nanoshells and alternating magnetic fields to generate heat in localized points. This paper evaluates the use of aqueous ferrofluid composed of $Mn_xZn_{1-x}Fe_2O_4$ nanoparticles for cooling applications in the ambient temperature range. The use of ferromagnetic fluid for cooling applications represents an encouraging alternative to traditional methods; the fact that the fluid can be pumped with no moving mechanical parts, using the magnetocaloric effect, can be a great advantage for many applications where maintenance or power consumption are undesirable. A magnetic fluid suitable for this specific application has to have certain specific properties, like low Curie temperature (T_c), high saturation magnetization (M_s), low viscosity and high specific heat. The selection of this ferrofluid is made based on these properties. The synthesis of the ferrite nanoparticles was carried out by chemical precipitation and the process is described further on. Magnetic characterization of $Mn_xZn_{1-x}Fe_2O_4$ nanoparticles includes the determination of M_s as a function of composition at 300˚K and the dependence of M_s with temperature for a specific 'x' value. Both types of measurements were carried out by using SQUID (Superconducting Quantum Interference Device) magnetometer.

[Chemistry-06]

Casañas, Barbara, UPR-RIO PIEDRAS; Morales-Garcia, Mara, Montes, Ingrid; Colon, Jorge, Santiago, Mitk'el; Dept. of Chemistry, UPR Rio Piedras

Characterization Of Inorganic Complexes Intercalated Into Zirconium Phosphate Layers For Electrochemical Applications

We are interested in the immobilization by direct ion exchange of redox inorganic complexes into layers of a highly hydrated phase of the layered inorganic material zirconium phosphate (ZrP) (known as the 10.3 Å phase of ZrP), for sensing applications. The zirconium phosphates are acidic inorganic ion exchangers. We are interested in derivatives of ferrocene, an organometallic compound that has been used as electron mediator in amperometric sensors. We have performed the synthesis of four derivatives of ferrocene and have completely characterized them. The direct intercalation of these derivatives into ZrP was performed. The ferrocene derivatives and the intercalated materials were characterized using UV-vis spectrophotometry, NMR spectrometry, IR spectroscopy, and cyclic voltammetry. The intercalated materials were characterized using X-ray powder diffraction, UV-vis spectrophotometry, IR spectroscopy, and cyclic voltammetry. For the cyclic voltammetry experiments of the intercalated materials we prepared modified carbon paste electrodes of the different loading levels of the intercalated material to analyze their electrochemical behavior. We will present the electrochemical characteristics of the unintercalated ferrocene derivatives as well as those of the intercalated materials.

[Chemistry-07]

Castillo, Betzaida, UPR-RIO PIEDRAS; Ricardo Sola, Dept of Chemistry, UPR Rio Piedras; Amaris Ferrer, Grabriel Barletta; Dept of Chemistry UPR Humacao, Kai Griebenow, Dept of Chemistry, UPR Rio Piedras

Engineering of Biocatalysts for Organic Media

The employment of enzymes as catalysts within organic media has traditionally been hampered by the reduced enzymatic activities when compared to catalysis in aqueous solution. Although several complementary hypotheses have provided mechanistic insights into the causes of diminished catalysis, further development of biocatalysts would greatly benefit from effective chemical strategies (e.g., PEGylation) to ameliorate this activity loss. Herein we explore the effects of altering the solvent composition from aqueous to 1,4-dioxane on structural, dynamical, and catalytic properties of the model enzyme subtilisin Carlsberg (SBc). Furthermore, we also investigate the effects of dissolving the enzyme in organic solvent through chemical modification with poly(ethylene)-glycol (PEG 20 kDa) on these enzyme properties. In 1,4-dioxane a 10^4 fold decrease in the enzyme's catalytic activity was observed for the hydrolysis reaction of vinyl butyrate with D_2O. This could be partially explained by the 50%

decrease in enzyme structural dynamics as evidenced by reduced amide H/D exchange kinetics. Attaching increasing amounts of PEG to the enzyme reversed some of the activity loss. Evaluation of the structural dynamic behavior of the PEGylated enzyme within the organic solvent revealed an increase in structural dynamics with increased PEGylation. Correlation analysis between the catalytic and structural dynamic parameters determined revealed that the enzyme's catalytic activity and enantioselectivity depended on the changes in protein structural dynamics within 1,4-dioxane. These results thus evidence the importance of protein structural dynamics towards regulating the catalytic behavior of enzymes within organic media and highlight the potential of chemical modifications for the tailoring of enzyme catalysts.

[Chemistry-08]

Cedeño, Yarilyn, UPR-MAYAGUEZ; Perales-Pérez, Oscar, Engineering Science & Materials, UPR-Mayaguez; Román, Félix, Chemistry, UPR-Mayaguez; Tomar, Maharaj S., Physics, UPR-Mayaguez

Optimization Of Magnetic Properties In Cobalt Ferrite Nanocrystals

Among the various ferrite materials for magnetic recording applications, cobalt ferrite ($CoFe_2O_4$) possesses excellent chemical stability and good mechanical hardness. The presence of a larger positive first order crystalline anisotropy constant (K_1) has made this ferrite a promising candidate for magneto-optical recording media. In addition to the precise control on the composition and structure of $CoFe_2O_4$, the success of its practical application will depend on the capability of controlling particle size at the nanoscale.

It is known that the crystal size is closely related to the relative interdependence between the nucleation and growth steps, which in turn can strongly be affected by the solution chemistry and precipitation conditions. On this basis, our research involves a modified co-precipitation approach that allows controlled growth of cobalt ferrite nanocrystals within the superparamagnetic and single domains limits and, subsequently, high coercivity at room-temperature. This size-controlled synthesis approach became possible by controlling the oversaturation conditions during ferrite formation. Optimum oversaturation was achieved by a precise monitoring of the feeding flow-rate of reactant solutions. XRD and FT-IR analyses confirmed the formation of the ferrite for a reaction time as short as five minutes. Room-temperature M-H measurements verified the strong influence of synthesis conditions and crystal size on the magnetic properties of ferrite nanocrystals. A complete discussion of the optimization of the magnetic properties in ferrite nanocrystals will be de presented. In a subsequent stage, optimized ferrite crystals will be used as pre-existents nuclei (seeds) to promote crystal growth.

[Chemistry-09]

Contés-de Jesús, Enid, UPR-RIO PIEDRAS; Rosario-Castro, Belinda, UPR-Rio Piedras; Cabrera, Carlos, UPR-Rio Piedras

Lithium Intercalation on a SWCNTs Modified Electrode

Single Walled Carbon Nanotubes (SWCNTs) are single graphene sheets rolled up in a tubular fashion with half-fullerene capping at each end. SWCNTs have unique characteristics such as functionalization capacity, great tensile strength, high thermal and chemical stability, and conductivity. This kind of carbonous structures can be a possible material as anode in lithium ion (Li-ion) batteries improving their performance and Li storage capacity.

An electrode was fabricated modifying a metallic surface with SWCNTs. After modification, intercalation and de-intercalation of Li (charges and discharges) were performed using $LiClO_4$ in ethylene carbonate (EC) and diethyl carbonate (DEC) as electrolytes and lithium foil as counter and reference electrode.

Cyclic voltammetry (CV) was done to confirm the intercalation and de-intercalation process. The reversibility and irreversibility of the system was calculated from the charges and discharges data. Surface analysis before and after intercalation processes were performed using X-ray photoelectron spectroscopy (XPS). A peak around 55.6 eV corresponds to Li 1s.

[Chemistry-10]

Diaz, Yisaira, UPR-RIO PIEDRAS; Arce, Rafael, Universidad de Puerto Rico - Recinto de Rio Piedras; Alegria, Antonio, Universidad de Puerto Ricon en Humacao

DNA binding constants of photosensitizer dyes and of alkylating quinones and nitroarenes with potential use in photodynamic therapy in hypoxic environments

One of the most promising anticancer therapies, discovered in the early 1900s, and still under investigation is Photodynamic therapy. PDT uses a combination of a red laser light, a photosensiziting agent, and molecular oxygen to bring about a therapeutic effect. A Type I pathway is most efficient in hypoxic environments and high substrate concentration. This pathway involves the photoreduction or photooxidation of substrates, if the substrate is a DNA alkylating quinone or nitroarene, these could act as an alkylating species and DNA alkylation should be expected, with the consequent cell death. The objective of our work is to measure binding constants for the dye photosensitizer, and for the alkylating quinones and nitroarenes to DNA or oligonucleotides and multilamellar vesicles (MLVs) of dimiristoylphosphalidylcholine (DMPC); this could allow us to determine the relative hydrophobicity and amount of the photosensitizer and quinone/nitroarene bound to DNA or to a lipid membrane. These binding constants are been determined by a competition method with the well-known DNA intercalator, ethidium bromide, EB. The competition method is

based on the fluorescence or absorbance titration method of EB in the absence and presence of the calf-thymus DNA, followed by a Scachard analysis according to the modified equation of McGhee and von Hippel. Preliminary results indicate that EB presents a DNA binding constant of the order to 10^5.

[Chemistry-11]

Díaz, Agustín, UPR-RIO PIEDRAS; Martínez-Rivera, Melissa C., Department of Chemistry, University of Puerto Rico; Medina-Morales, Annette M., Department of Chemistry, University of Puerto Rico; Colón, Jorge L., Department of Chemistry, University of Puerto Rico

Intercalation of Fullerene (C60) into Inorganic Layered Frameworks

Fullerenes (C_{60}) have potential for biomedical applications but their lack of solubility reduces considerably their usefulness. Among the applications of the fullerenes are their uses as: HIV-protease inhibitor, antitumor, antibiotic, and neuroprotective agent, among others. In order to exploit the biological potential of C_{60} it is necessary to find a way to solubilize it. Water solubility is strongly desirable in any drug, in order to be administrated in the aqueous environment of the biological system. Our approach is to find a way to transport C_{60} in an aqueous system. We are using two different types of inorganic layered material known as zirconium phosphates (ZrP) and layered double hydroxides (LDH) as vehicle. ZrP are cation exchangers and LDH are anions exchangers and both posses the capacity to incorporate molecules with different sizes between their layers. Commonly, non-ionic molecules do not intercalate directly into ZrP and LDH, due to the lack of electrostatic interaction with the charged layers. The diversity of molecules that can be intercalated into LDH and ZrP could be increased by the modification of the internal galleries of the materials with different types of species such as cyclodextrins (CD). Another approach that could be used to intercalate C_{60} into the layered materials could be achieved by modifying the surface of the C_{60} to impart it an ionic character. These kinds of modifications open the window of possible guest molecules with the potential to be intercalated into restricted geometries. The results of the modifications and intercalation of the material will be presented.

[Chemistry-12]

Enríquez, Yanira, UPR-RIO PIEDRAS; Rivera Rivero, Christia M., Chemistry, University of Puerto Rico; Pedró Rosa, Laura E., Chemistry, University of Puerto Rico; Montes, Ingrid, Chemistry, University of Puerto Rico, Guadalupe, Ana R., Chemistry/,University of Puerto Rico

Spectrometric Characterization of Novel Ferrocene Derivates

Ferrocene is an organometallic compound consisting of two cyclopentadienyl rings bound on opposite sides of a central metal atom. Such organometallic compound is also known as sandwich compounds. In ferrocene,

the six π-electrons of each aromatic cyclopentadienyl anion are shared with the central Fe^{2+} ion, resulting in an inert gas electron configuration. This configuration makes ferrocene particularly stable. Ferrocene countless derivatives, including both mono and disubstituted derivatives, extend the range of possibilities for study. Our work consists in the spectrophotometric characterization of a series of novel ferrocene derivates prepared from Acetyl Ferrocene using the Claisen-Schmitz reactions. These derivates have similar structures but differ in the functional groups in the benzene ring. ^{1}H-NMR, ^{13}C-NMR and FT-IR characterization has already been done. We did the spectrophotometric analysis to study the behavior of these compounds when light is applied and explore their potential application as catalysts or photo electroactive labels. The solutions for the ferrocene derivates were prepared over a range of 1 x 10^{-3} M → 1 x 10^{-5} M using Acetonitrile as the solvent. The experiments were run in triplicates over a range of λ-1100nm → λ-190nm. The UV-Vis spectra obtained show some bands representative of the functional groups in study and some other bands which are under study. We identified the band of Acetyl Ferrocene from λ-540nm → λ-400nm, the Br band in λ-350nm → λ -200nm and the OCH_3 band from λ-400nm → λ-300nm. We are currently working in the designation of such bands to explore these compound potential as photoactive labels in DNA biosensors development and also their electrochemical properties.

[Chemistry-13]
Feliciano, Raquel, UPR-MAYAGUEZ; Castro Miguel

Quantum Dots sensing: The effect of NO2 containing organic on CdS blinking

Quantum dots are nanoparticles that exhibit particle size dependent fluorescence properties. Among these properties, there is one known as "blinking" which is proposed to result from differences in electron-hole recombination kinetics among the different QD that can exist in a given sample. Measurements of the nanoparticle blinking frequency are an active research area due to their potential role in sensing. In this presentation, we report on ongoing research activities towards understanding the effect of local chemical environment in the QD blinking frequency using femtosecond laser spectroscopy and transmission electron microscopy. Results on the effect of TNT in the blinking rate of samples of CdS QD will be presented.

Keywords: QD's (Quantum dots), blinking, TNT, femtosecond laser

[Chemistry-14]
Ferrer, Edmy, UPR-MAYAGUEZ; Gonzalez Lidiany, Chemistry; Castro Miguel, Chemistry

Nanotechnology Undergraduate Education: An Active Learning Approach

Active learning is an approach to education in which students participate in goal setting and are free to create and pursue new goals. We presented how a number of concepts in nanotechnology, including quantum effects, particle size effects, and microscopy and spectroscopy are introduced to students using active learning activities. Two examples of these active learning modules will be presented, the synthesis of gold nano particles and Ag nanoclusters. In the first experience, the students learn that the physical properties of nanoparticles are linked to their electronic properties as they observe fluorescence in gold nanoparticles with diameters smaller than 2.5 nm, which have an electronic structure similar to the one observed in macromolecules, while the appearance of metallic character is accompanied by the strong absorption of light by the gold plasmon. A second active learning experience presents the students the challenging task of using chemicals to assemble particles into wires using wet chemical methods. In this experience, the students use a simple alkyl thiol to assemble silver into linear wires, which are observed with the use of an inexpensive optical microscope. The strategies employed to bring these activities into the classroom and undergraduate teaching laboratory and the participation of the instructor and students are presented in the context of the active learning approach to college education in science and engineering.

[Chemistry-15]
Flores, Giselle, UPR-RIO PIEDRAS; Diaz, Myriam, Chemistry, UPR- Rio Piedras; Rodriguez, Jose A., Chemistry, UPR- Rio Piedras; Griebenow, Kai, Chemistry, UPR- Rio Piedras

Mechanism of Moisture Induced Solid Phase Aggregation of Pharmaceutical Proteins

Solid protein pharmaceuticals often suffer from instability problems hampering their successful therapeutic application. Upon storage, proteins may become partially hydrated and detrimental moisture-induced aggregation is observed. The extent of protein aggregation has been related to the amount of water sorbed and often a bell-shaped curve is observed when plotting the amount of aggregates formed versus the relative humidity used to incubate the protein. One frequently formulated hypothesis in this context is that partial hydration influences protein dynamics and thus unfolding in the solid state. Simply put, increased hydration leads to increased protein dynamics allowing for unfolding and aggregation. The decrease in protein aggregation at very high relative humidity in this model is explained by protein refolding. However, thus

far, no solid data on protein structure in partially hydrated states after incubation under defined humidity conditions have been published and thus the hypothesis has not verified.

To test the hypothesis, lyophilized insulin powder was incubated in humidity chambers at various relative humidities. Formation of buffer insoluble aggregates was monitored for these samples for weeks. To detect unfolding/refolding events occurring to the solid protein powder, these were subjected to analysis by Fourier-transform infrared spectroscopy after 48 h of incubation (after this time the system is in complete equilibrium). We employed an FTIR-microscope using a diamond cell to avoid exposing the moist protein powders to the high pressure encountered in the formation of a KBr pellets usually employed in such studies on solid protein powders. Furthermore, to avoid artifacts by water vapor and sorbed water, the amide III region (1220-1330 cm^{-1}) was used. Results obtained show that insulin forms aggregates upon storage in humidity chambers. Preliminary analysis of the FTIR data currently point in the direction that the hypothesis explaining the bell-shaped curve is correct, but further experiments are currently ongoing to verify this.

[Chemistry-16]

García, María del Mar, UPR-RIO PIEDRAS; Cardona, Rocío del A., Chemistry, UPR-Río Piedras; Montes, Ingrid, Chemistry, UPR-Río Piedras; Guadalupe, Ana R., Chemistry, UPR-Río Piedras

Electrochemical Characterization of Novel Ferrocene Derivatives

Ferrocene and its derivatives have been used in a wide series of applications that goes from electrocatalytic and analytical to biomedical ones. Our work consists in the electrochemical characterization of a series of novel Ferrocene derivatives prepared from Acetyl Ferrocene using the Claisen-Schmitz reaction. These derivatives share a similar structure except for the functional groups in the benzene ring. After ^{1}H-NMR, ^{13}C-NMR, FT-IR, and spectrophotometric characterizations, the redox properties of the derivatives have been studied by Cyclic Voltammetry. General results show that all compounds showed characteristics ferrrocene redox waves. Additional redox signals were also observed which are under study. One of the derivatives has a dimethylamino group as substituent at the *para* position in the benzene ring. This derivative has shown electro polymerization when the potential window is opened. We are currently working in the alkylation of the amine group to impart it a positive charge. Also we are studying its interaction with nucleic acids to use it as an electrochemical label in DNA biosensors development.

[Chemistry-17]

Hernández, Griselle, UPR-RIO PIEDRAS; Madeline Díaz, Chemistry, University of Puerto Rico Rio Piedras Campus

Polymer Modified Glassy Carbon Electrode for the Determination of Fe(II) Ions

The development of sensors for the determination of toxic metal ions in food samples and environmental sites is important. Our research goal is the development of an electrochemical sensor for the determination of Fe(II) metal ions. To accomplish this goal, we plan to use polystyrene-modified carbon electrode surfaces as the platform for the construction of metal ions sensor. We will anchor 5-amino-1,10-phenanthroline ligands onto these surfaces and entrap the Fe(II) ions. The complex reaction will be followed electrochemically using Osteryoung Square Voltammetry. The 5-amino-1,10-phenanthroline complex was characterized by Cyclic Voltammetry in 5 x 10^{-4} M Fe/HH solution, using glassy carbon electrodes, Ag/AgCl and Nichrome as working, reference and auxiliary electrode respectively. UV-VIS spectroscopy was used to follow the complex formation.

We synthesized polystyrene bifuncionalized (-COOH) with molecular weight 24,710 g/mol and it was characterized by HPLC-SEC, Titration and FT-IR techniques. The glassy carbon electrode was modified with the polymer by the spin coating technique after which the 5-amino-1,10-phenanthroline ligand was anchored. The formation of Fe(II)-5Aphen complex at the surface was detected by Osteryoung Square Voltammetry. In a future, we expect to study the sensor response as function of the amount of ligand, the immobilization time, the ion exposure time, the buffer type and the pH. Also we will construct the calibration plot to determine the sensor detection limit. We expect to develop a general sensor platform to detect other ions in solutions.

[Chemistry-18]

Leon, Madeline, UPR-MAYAGUEZ; Marissa Morales, Chemistry/ UPRM; Roberto Irrizarry, Research Triangle Park, Electronic Technologies, North Carolina; Miguel Castro, Chemistry/ UPRM

The electron conduction in colloidal system:a kinetic study of Ag2S semiconductor nanoparticle formation.

The synthesis of metal and semiconductor nanoparticles has received widespread attention by the scientific community due to the large number of technological applications they find in nanoscaled systems. The mechanism of nanoparticle growth is, in general, still an open question. A few studies have relied on the fluorescence of semiconductor nanoparticles to monitor particle growth. These previous works have contributed significantly to the current body of knowledge related to the mechanism of nanoparticle assembly. The general picture that emerges from these previous works is that nanoparticles in solution form from the self assembly of atoms and nuclei in solution. The driving forces involved in this self assembly are not well known. There is little doubt that

electrostatic and magnetic interactions among atoms and small nuclei play an important role in nanoparticle synthesis and growth.

The purpose of this work is to explore on the use real time-conductivity measurements as an alternative tool to measure the kinetics of nanoparticle growth. Electron conduction in colloidal systems is typically though as resulting from electron hopping from one component to another in solution. Such electron conduction reflects then the electrical stability and order of the colloid, which are well known to result from a delicate balance of electrostatic and magnetic forces. For this purpose, we have focused in the synthesis of Ag2S from the reaction of silver cations, Ag+, with sulfide anions, S-2. Ag2S semiconductor nanoparticles absorb light deep in the UV (about 230-240 nm) and exhibit a strong fluorescence in the visible at low temperatures. Conductivity measurements on this synthesis are an attractive approach to study the mechanism of nucleation. In this work a stopped flow system is used to study reaction growth kinetics of the formation of Ag2S nanoparticles. The kinetic data obtained indicates that the reaction mechanism involves multiple steps or a square root dependence of k on concentration must be taken into account in the quantitative analysis of the data formation. Conductivity and optical absorption measurements indicate that the semiconductor, nucleation and coalescence of particles occur in a time scale shorter than 5 seconds after the flow of Ag+ and S-2 is brought to a stop.

[Chemistry-19]

López, José Luis, UPR-MAYAGUEZ; Román, Félix, Department of Chemistry, UPRM; Perales-Pérez, Oscar, Department of General Engineering-Materials Science and Engineering, UPRM; Nieto, Sorelis, Department of Chemistry, UPRM

Evaluation of the adsorption behavior of Tetracycline onto recycled crumb rubber and carbon black in aqueous solutions by liquid chromatography/mass spectrometry (LC/MS/MS)

The adsorption behavior of tetracycline (TC) onto carbon black (CB) and different sizes of ground tire crumb rubber (CR) in aqueous solutions was evaluated. TC samples at pH 3.80 with exposition times up to 168 hours at room temperature were placed in contact with CR and CB in the presence and absence of Zn and EDTA. The samples were removed at different time intervals and analyzed using LC/MS/MS. The sorption capacity was dependent on mesh size, presence of Zn in solution, acid wash and the addition of EDTA as a metal complexing agent. Results also showed variability in TC removal. At 168 h, the TC removal by CR of mesh 1420 and CR of mesh 30 were 48.22 % and 59.80 %, respectively. CR results were compared with CB, which completely removed TC from aqueous solution after 24 hours of contact time.

[Chemistry-20]

Mendez, Jessica, UPR-RIO PIEDRAS; Wasfi Al-Azzam, Biology Dept., UPR-Rio Piedras; Emil A. Pastrana, Brian King; Kai Griebenow, Dept. of Chemistry, UPR Rio Piedras

Effect Of The Covalent Modification Of Horseradish Peroxidase With Poly(Ethylene Glycol) On The Activity And Stability Upon Encapsulation In Polyester Microspheres

Encapsulation of proteins in polyester microspheres by coacervation methods frequently causes protein inactivation and aggregation. Furthermore, an often-substantial amount of the encapsulated proteins is released within the first 24 h from the microspheres. To overcome these problems poly(ethylene glycol) (PEG) was employed as excipient and protein-modifying agent. The model protein horseradish peroxidase (HRP) was chemically modified or co-lyophilized with PEG of differing molecular weights, namely $PEG_{5,000}$, $PEG_{20,000}$, and $PEG_{40,000}$. The lyophilized preparations were encapsulated in poly(D,L-lactide-*co*-glycolic) acid (PLGA) microspheres by a coacervation method. Covalent modification of HRP with PEG increased the encapsulation efficiency from 83% to about 100% while PEG when used as an excipient reduced the encapsulation efficiency. Encapsulation caused aggregation of ca. 5% of non-modified HRP and the residual specific activity was only 57%. Covalent modification with PEG reduced HRP aggregation to less than 1% and improved its residual activity to more than 95%. When PEG was used as excipient similar results were found with respect to a reduction in encapsulation-induced aggregation, but no more than 80% of residual activity were obtained even for the best formulation after encapsulation. It was also found that covalent modification of HRP with PEG substantially reduced the unwanted initial "burst" release observed during the initial 24 h of *in vitro* release from about 70% to 23%. Furthermore, HRP activity and stability were also improved during *in vitro* release for HRP-PEG conjugates. The data show that covalent modification of proteins with PEG might be useful to improve protein stability during coacervation encapsulation and subsequent release as well as to increase encapsulation efficiency and reduce the burst release.

[Chemistry-21]

Montalvo, Brenda Liz, UPR-RIO PIEDRAS; Sosa, Brian; Velez, Denisse, Griebenow, Kai, UPR-Rio Piedras, Chemistry Dept; Needham, David, Duke University, Dept of Mechanical Engineering and Material Science; Center for Biologically Inspired Materials and Material Systems

Formation of partially dehydrated protein microparticles

Proteins and peptides have an enormous potential to be used as therapeutic drugs. For that reason it is of pharmaceutical importance to maintain their stability and function during production, formulation, storage and delivery.

Several approaches have been done to accomplish this. For example, lyophilzation has been used as a method to stabilize proteins in the solid state. However, many therapeutic proteins suffer inactivation upon lyophilization. In this research, glassification has been investigated as an alternative protein dehydration method. Our hypothesis is that the protein in the glass state is partially dehydrated; thus it will maintain its stability. Glassification of proteins is performed by making a concentrated aqueous protein solution and suspending it in an organic solvent that is not miscible in water. In this study we used ethyl acetate, butyl acetate, ethyl formate and methyl acetate as the solvents to glassify horseradish peroxidase. We explored the glassification process by studying the structure of horseradish peroxidase formulated as glass beads and the process of bead formation. The glassified protein structure was studied by Circular Dichroism and Fourier-transform Infrared (FTIR) Spectroscopy. The kinetics of the glassification process in the organic solvents was determined by particle size analysis with a laser diffraction technique. The results show that the tertiary structure of horseradish peroxidase was similar to that of the native (HRP in phosphate buffer pH 6.5) when ethyl acetate, butyl acetate and methyl acetate were used to glassify horseradish peroxidase. On the contrary, there was a structural change when ethyl formate was used for protein glassification. We determined by the analysis of the FTIR spectra that the structure of the glassified protein is more similar to that of the native protein, than the structure of the lyophilized protein powder. We found out that the solidification time of protein beads is dependent on the homogenization speed and it is related to the water solubility property of each solvent. The size of the protein microparticle depends on the viscosity of the solvent used. The glassification process didn't affect irreversibly the protein, since we recovered 100% activity for all solvents except for ethyl formate (75%). The glassification process is an effective dehydration method, preserving protein structure and function.

[Chemistry-22]

Morel, Maria C., UPR-RIO PIEDRAS; Arce, Rafael, Chemistry Dept, UPR Rio Piedras

Photophysical and photochemical properties of 1,8-dinitropyrene adsorbed

Nitrated polycyclic hydrocarbons are of considerable concern because of their genotoxicity and ubiquity in the atmosphere. Among nitroarenes, dinitropyrenes, well known mutagenic and carcinogenic compounds, are found in the atmospheric particle matter. The transformations of these ubiquitous pollutants in the atmosphere are not well understood. In this study, 1,8-DNP is used as a model compound to study its photochemical and photophysical properties on silica gel and acidic alumina as models of the atmospheric particulate matter. Unirradiated 1,8-DNP adsorbed on silica gel present maxima at 292 nm and 397 nm, while in acidic alumina a red shift to 411 nm was observed. Fluorescence emission spectra of unirradiated samples reveal a broad emission band at 460 nm (475 nm for acidic alumina) as observed in

solution, while a new band at 339 nm is also observed for silica gel. Continuous photolysis of 1,8-DNP adsorbed on the models result in a decrease of the nitro characteristic absorption band at 397 nm. Simultaneously, a new band with maxima at 450 nm grows with irradiation time indicating its photodegradation, and further transformation into products. Similar behavior is observed on fluorescence emission spectra where a broad band at 518 nm increases with irradiation time. Irradiated samples of 1,8-DNP in acetonitrile show a similar spectroscopic behavior leading to products such as hydroxy-nitropyrenes and pyrenediones. This suggests that these could be among the photoproducts form on the surfaces. The incorporation of these functionalities is in agreement with the proposed nitro-nitrite rearrangement for the phototransformation of other nitroarenes.

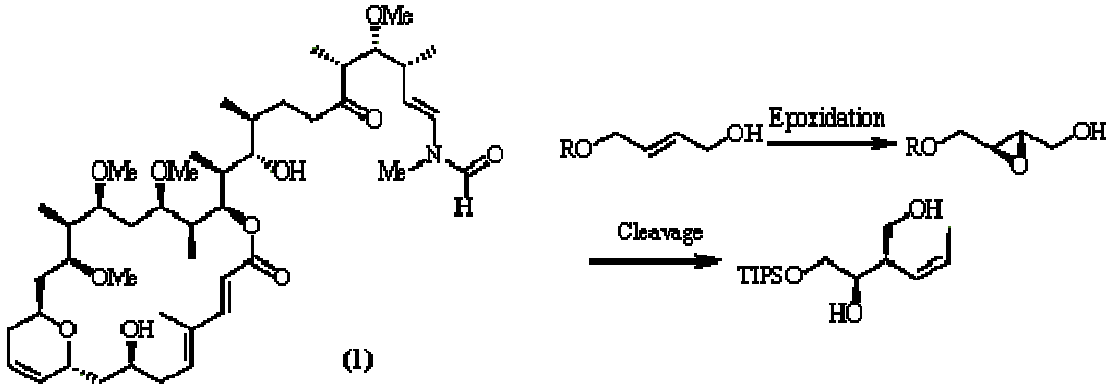
The financial support by NIH SCoRE (grant 55066M08102), PRSGP NASA and Marc (grant 2-T34GMO7821-26) is gratefully acknowledged.

[Chemistry-23]

Rentas, Jaileen, UPR-RIO PIEDRAS; Rodríguez, Raúl, Chemistry, UPR-RP; Rodríguez Reyes, David, Chemistry, UPR-RP; Prieto, José A.*, Chemistry, UPR-RP

An Epoxide-Based Approach Towards The Preparation Of Scytophycin C Polypropionate Chain

Polypropionate compounds represent an important class of natural products with interesting biological activity. Scytophycins, exhibit potent cytotoxicity against some human carcinoma cell lines, and a broad-spectrum of antifungal activity. Specifically, Scytophycin C (**1**) is characterized by a macrolide containing a dihydropyran ring and a unique polypropionate-derived structure having a terminal methyl vinyl formamide moiety and a total of 15 stereogenic centers. We have undertaken a study toward the synthesis of the scytophycin C polypropionate chain using a combined epoxide-based reiterative and convergent approach. Our method is based on two key steps: stereoselective epoxidation of allylic and homoallylic alcohols, and their further regioselective cleavage with diethyl alkyny alanes, alanates or alkenyl Grignard reagents. The incorporation of an allylic hydroxy functionality allows for improved stereoselectivity on the epoxidation step and better regioselectivity in the epoxide cleavage reaction. The results on our initial studies will be presented. (NIH SCORE (2S06GM-08102-29) and AGEP (HRD-0302696).



[Chemistry-24]

Rivera, Lizmarie, UPR-RIO PIEDRAS; Karilys Gonzalez, Adrian Lugo; Dept of Chemistry, UPR Rio Piedras, Ricardo Gonzalez; Dept of Radiology, Medical Science Campus, UPR, Raphael Raptis, Dept of Chemistry, UPR Rio Piedras

Development of Iron-Based MRI Contrast Agents

Magnetic Resonance Imaging (MRI) has emerged as one of the leading non-invasive medical diagnostic techniques, generating an increase in the production of a variety of injectable, contrast-enhancing agents (CAs). This CAs need to be water soluble, paramagnetic compounds, that provide a shortening of the relaxation time of their proximal water protons, providing an enhancement in the intrinsic contrast of MR images. A hydrophobic iron-pyrazolate cluster $Fe_8O_4(pz)_{12}Cl_4$ is proposed as a basis for the development of new contrast agents. In order to make it soluble, we are employing surfactant like cremophor^{TM}, β and γ- cyclodextrins (CD) and a starch-iodine complex. Experiments have addressed to the pH dependence, relaxation time (T_1 and T_2) dependence on cluster concentrations, stability measurements and electrochemical experiments of the $Fe_8O_4(pz)_{12}Cl_4$ cluster. We found that the $Fe_8O_4(pz)_{12}Cl_4$ cluster is soluble and stable in a cremophor/water solution. MRI phantoms experiments conducted in vials containing an known iron cluster concentration show a good contrast enhancement. The T_1 and T_2 experiments show that the iron cluster has a better relaxivity than commercial Gd-based contrast agent.

[Chemistry-25]

Sanchez, Diana, UPR-MAYAGUEZ; Alamo, Luis, Chemistry; Calisir, Ferah, Chemistry; Roman, Felix, Chemistry, Perales, Oscar, Engeniering

Removal Of Toxic Metals From Aqueous Solutions Using Waste Tire Crumb Rubber As Sorbent

The removal of toxic heavy metals ions from aqueous solutions using waste tire crumb rubber (WTCR) as low cost sorbent was studied. Metals solutions were subject to diverse: pH, metal concentration and size of the rubber. The results show that at grater superficial area of the WTCR, the metal uptake was better. Also, when the initial concentration of the metals was less (1 or 5 ppm), the equilibrium sorption time was reached faster. The crumb rubber is an excellent sorbent for metals like Cu(II) and Pb(II). Other metals like Cd(II) and As(III) were also studied but the sorption seems to be minor. The assumption that the mechanism of sorption is facilitated by ionic exchange with ZnO, is supported when at grater metal uptake, more zinc is liberate to the solution. Future works pretends to activate the rubber on chemical and thermal methods in order to increase it sorption capacity.

[Chemistry-26]

Santiago, Diana, UPR-RIO PIEDRAS; Cabrera, Carlos R., Dept. of Chemistry, UPR Rio Piedras

Characterization and Analysis of Pt/C Nano-Catalysts Prepared Using Rotating Disk-Slurry Electrode Technique

The direct methanol fuel cell (DMFC) is an attractive power source for portable power and vehicle applications. An effort to develop smaller and well disperses catalytic material at high surface area supports and to reduce the catalyst loading is required. In terms of pure metal catalysts, platinum has shown the highest activity for methanol oxidation. Also it can be alloyed with other metals, as ruthenium, which exhibits catalysis considerably higher for methanol electro-oxidation rates than pure platinum. In the present work the Pt/C nano-catalysts preparation was done by electrodeposition at constant potential using a glassy carbon rotating disk electrode. The electrodeposition was carried out in a solution containing carbon black (Vulcan XC-72R), K_2PtCl_6 and 0.1M H_2SO_4. The Pt deposition was analysed by TEM, nano XRF, XPS, and XRD. TEM image showed Pt particles with sizes between 12 and 2 nm in diameter. The nano XRF, XPS, and XRD confirm the presence of platinum nanoparticles showing the characteristic peak of this element. XRD analysis demonstrate the polycrystalline structure of the platinum deposited with the (111), (220) and (200) peaks. The use of the rotating disk-slurry technique was an effective method for the platinum electrodeposition at carbon powder material because we can obtain well-dispersed platinum nanoparticles.

[Chemistry-27]

Soto, Lydia Liz, UPR-RIO PIEDRAS; Mayol-Bracero, Olga, Gonzalez, S.; Institute for Tropical Ecosystem Studies and Dept of Chemistry, UPR Rio Piedras, Andreae, OW; Andreae, TW, Elbert, W, Trebs, I, Dept of Biogeochemistry, Max Planck Institute of Chemistry, Mainz, Germany, Artaxo, P, Institute of Physics, Univ of Sao Paulo, Brazil; Maenhaut, W, Institute of Nuclear Sciences, Ghent Univ, Belgium; Kirchstetter, T & Novakov, T, Lawrence Berkeley National Lab, Berkeley, CA

Chemical apportionment of size-resolved aerosol particles during the dry-to-wet period in the Brazilian Amazon

Size-resolved chemical characterization was performed on aerosol samples collected in a pasture site in the Amazon Basin as part of the project LBA-SMOCC 2002 (*Large Scale Biosphere Atmosphere Experiment in Amazonia - Smoke Aerosols, Clouds, Rainfall and Climate: Aerosols from Biomass Burning Perturb Global and Regional Climate).* The sampling period (Sept. to Nov. 2002) included the end of the dry season, the transition period, and the beginning of the wet season. Real-time measurements of particle number concentrations were performed simultaneously with aerosol filter sampling. A Dekati low-pressure impactor (DLPI) with 13 stages was used to collect particles with diameters below 10 □m and above 0.03 □m. The mass concentrations on the DLPI aluminum substrates were determined by gravimetric analyses. The determination of the concentrations of carbonaceous species (elemental carbon and organic carbon) and the water-soluble ions (Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, NO_3^-, SO_4^{2-}) was performed using evolved gas analysis and ion chromatography, respectively. A light transmission method was used to determine the mass concentrations of the absorbing fraction for the size-resolved samples.

Preliminary results show that carbonaceous aerosol comprised more than 85% of the total aerosol mass during the three sampling periods. Particle number concentrations showed seasonal variation (dry: 8000 cm^{-3} and wet: 2000cm^{-3}). Size-resolved mass concentrations showed higher concentration during nighttime (day vs. night: 40.9 μg m^{-3} vs. 76.9 μg m^{-3}). During the dry period, mass concentrations were higher for the fine fraction (56.7 μg m^{-3}) than for the coarse fraction (4.1 μg m^{-3}) because of the burning of biomass and the fine aerosol was composed mainly of pyrogenic aerosols (SO_4^{2-} (30%), NO_3^-, (26%), NH_4^+ (20%), and K^+ (20%)) while the coarse fraction was mainly composed of biogenic (NO_3^- (46%), Na^+ (22%) and SO_4^{2-} (12%)). For samples collected in this dry period, the size-resolved carbonaceous material measured by the light transmission method showed the highest concentrations for particles with diameters between 0.1 to 0.6 μm, at the beginning of the wet season aerosols were mainly composed of biogenic particles with SO_4^{2-} (59%) and NH_4^+ (27%) dominating the fine fraction and SO_4^{2-} (28%), NO_3^- (29%) and K^+ (20%) the coarse fraction. Additional results on the size-resolved concentrations of the organic, inorganic, and mineral crust aerosol will be presented.

[Chemistry-28]
Suazo, Dámaris, UPR-RIO PIEDRAS

Functionalization Of Single-Wall Nanotube For Protein Immobilization For Biofuel Cell Applications

Biological fuel cells have been well defined as electrochemical devices in which the electrocatalyst at either cathode or anode is an organism or an enzyme. This biocatalyst offers a cost advantage over metallic catalyst. To enhance the electrons transfer between the enzyme and the platinum electrode surface we decided to attach functionalized single wall carbon nanotubes on a self-assembled monolayer of 1-dodecanothiol at the electrode surface. After the attachment of the nanotubes onto the platinum surface, immobilization of the enzyme will be performed. Techniques such as cyclic voltammetry, XPS, IR, TEM and EIS will be used for electrochemical and surface studies.

Electronics

[Electronics-01]
Gomez, Rodney, PUPR; Farahat, Nader, Electrical, PUPR

Analysis of Corrugated Circular Waveguides

The rising demand on High-power microwaves has led to the development of new devices in which corrugated circular waveguides and horns play a major role. Successful design of these structures requires an accurate analysis of the propagation properties inside the corrugated circular guide. In this work we analyze a corrugated cylindrical waveguide and present both the field distribution and in its cross section as well as its far field pattern. The results are compared with estimated formulas for the dominant hybrid modes typically excited in these guides. Both versions of Finite Difference Time domain Method *viz* conventional and body of revolution (BOR) are used for the simulations. In addition we show how the dimensions and number of the corrugations affects the performance of the corrugated guide and its far-field pattern.

[Electronics-02]
Lugo, Katherine, PUPR; Rivera, Anibal, Electrical Engineering, PUPR

Analysis of Metamaterials Structures Using Finite Difference Time Domain (FDTD) Method

In this paper we analyze several periodic structures, known as left-handed metamaterials, and obtain their effective permittivity and permeability by using the Finite Difference Time Domain (FDTD) Method. Metamaterials first were predicted theoretically by Victor Veselago in 1967 and in 2000 the first metamaterials was realized by use of split ring resonators. These artificial materials exhibit interesting properties that are not observed in the natural material. We compute the reflection and transmission coefficients of a slab of the material by using FDTD method by applying the periodic boundary conditions and next using these coefficients we retrieve their permittivity and permeability vs. frequency. The example of woodpile structure will be shown with the details of the simulation as well as the method to retrieve the constitutive parameters.

[Electronics-03]
Ortiz, David, UPR-MAYAGUEZ

Embedded C Optimization for Low Power Consumption on Microprocessors-Based Systems

Power consumption has become an important constraint in the design of embedded systems. The problem of minimizing power dissipation may be handled in terms of hardware or software optimizations. Previous studies have shown that hardware power optimizations can only be driven at early design phases, making software optimizations techniques a good choice, achieving good results in terms of low power consumption. In this work we propose high level language optimization techniques in order to minimize the effect that the software running on a microprocessor has on the power dissipated by an electronic device. In this research we highlight the importance of taking into consideration embedded software power optimization, validating certain performance optimization techniques in different applicable scenarios, and evaluating their results in terms of the power dissipated.

Engineering

[Engineering-01]
Arce, Rafael, UPR-MAYAGUEZ; Manuel Jimenez, Electrical and Computer Engineering, UPR-Mayagüez; Domingo Rodriguez, Electrical and Computer Engineering, UPR-Mayagüez

High-Level Partitioning of Discrete Signal Transforms for Distributed Hardware Architectures

Fast discrete signal transform (DST) algorithms, such as the Fast Fourier Transform, can attain considerable gains in performance when properly implemented to dedicated hardware devices, such as Field Programmable Gate Arrays (FPGAs) and Application Specific Integrated Circuits (ASICs). However, the large amount of logic resources required by these algorithms commonly obligates their mapping to distributed hardware platforms (DHAs), such as multi-FPGA boards. In these situations, effectively partitioning the algorithm among the available devices becomes a critical task.

Although several automated partitioning methods have been reported for DHAs, most of them are designed to solve general partitioning problems, and tend to apply generic local optimization techniques that miss out on alternate strategies that become apparent only with some knowledge of the algorithm's functionality. DST algorithms have topological and reformulation properties that offer opportunities for developing semantically guided high-level partitioning schemes that influence their mapping to hardware.

The main objective of our research is to define a methodology that incorporates DST-specific considerations into the partitioning optimization loop, in an effort to achieve a more straightforward exploration of the solution space and improved partitioning results, compared to general purpose methods. This poster discusses some of these considerations and presents the experimental results of several of our functionally-aware partitioning strategies. Our results evidence that the inclusion of functionally-aware transformations into the partitioning optimization loop improves solution quality and time of convergence.

[Engineering-02]
Bermudez, Erick, UPR-MAYAGUEZ; Gustavo Gutierrez, Department of Mechanical Engneering; Oscar Perales Perez, Department of Engineering and Material Sciences

Design and Mechanical Characterization of a Magnetocaloric Pump

In this paper, a Magnetocaloric Pump (MCP) is studied and designed to pump a magnetic fluid. Two water-based ferrite nanofluid ($Mn_xZn_{1-x}Fe_2O_4$) with x=0.5 and x=0.7 and one commercial hydrocarbon-based $Mn_{0.8}Zn_{0.3}Fe_2O_4$ nanofluid were compared in order to analyzed their magnetocaloric effect. For the water-based nanofluids a chemical co-precipitation method and a double layer surfactant technique were employed to produce the nanofluids. The effect of the saturation magnetization *Ms* and the Curie temperature in the pump performance as well as the heating source position inside the induced magnetic field (0.55T) were tested. For an x=0.5, the saturation magnetization of the fluid resulted to be minimum (4.18emu/g), having a minimum Curie temperature of 351K while the hydrocarbon-based ferrofluid presented higher saturation magnetization (11.93emu/g) but also a higher Curie temperature of 515K. Optimum operational conditions were established and the most efficient ferrofluid suitable for electronic cooling applications was selected according to the maximum pressure head reached by the pump and validated via the simplified Bernoulli equation for magnetic fluids.

[Engineering-03]
Cardona, Jahaira, UPR-MAYAGUEZ

Human Factors of Motorcycle Crashes in Puerto Rico

A dramatic increase of 92 percent (from 39,000 to 75,000 motorcycles) in registered motorcycles has been observed in Puerto Rico between the years of 2000 to 2005. Puerto Rico does not require a special permit to drive motorcycles. Any person with a valid learner permit is allowed to drive a motorcycle on the highway system, with the exception of freeways. The increase in motorcycles on the highway system and the high amount of untrained motorcycle riders have lead to a substantial increase in motorcycle-related fatalities in Puerto Rico. Ninety motorcycle-related fatalities were observed in Puerto Rico in 2005, a 75 percent increase from the year 2000.

Highway crashes are influenced by three main factors: the driver, the road geometry, and the vehicle. The purpose of this study is to analyze the human factors involved in motorcycle crashes in Puerto Rico. The human factors will be identified from the crash database of the Puerto Rico Highway and Transportation Authority, surveys and interviews made to police officers, medical emergency and trauma personnel, motorcycle riders, and other stakeholders, and behavioral data of motorcycle riders on the road.

The study will identify the contributory causes and human factors of motorcycle-related crashes. The results will show the main characteristics of motorcycle riders. These results are from a major research project that will produce recommendations, related to rider education and training, enforcement, and engineering, with the objective of reducing the frequency and severity of motorcycles crashes in Puerto Rico.

[Engineering-04]
Carrión, José, PUPR; Nader, Farahat, Electrical Engineering, Polytechnic University of Puerto Rico

Numerical Modeling of Patch Antenna

A Patch antennas using a new bandpass Frequency Selective Surfaces (FSS) is designed and the composite system (patch antenna covered by an FSS) is analyzed using the Finite Difference Time Domain (FDTD) Method. Far-field patterns of the patch antenna, with and without FSS radomes, are obtained and compared with each other. The feed is modeled by using a coaxial line extension, which enables us to compute the return loss of the patch and the composite system accurately. Numerical results show a frequency shift in the return loss response of the patch in the presence of the FSS cover.

[Engineering-05]
Charca, Samuel, UPR-MAYAGUEZ; Amilcar Quispitupa, Basir Shafiq; Engineering, UPR Mayaguez

Monitoring of Crack Initiation and Growing by Acoustic Emission in 7075 Aluminum Alloy in Corrosion Environment

The fatigue life of mechanical component are principally relating to the load applied, amplitude, frequency and which environment doest it. The Acoustic Emission (AE) is a nondestructive technique useful to monitoring the crack behavior along the initiate and growing process. Each mode of failure (damage) is characterized by a particular type of signal, related to the amplitude, duration and frequency of AE signal. To obtain a particular mode of failure samples of AA7075-T6 aluminum allow (compact tension specimens) are tested at different load ratio (R), in air and 3.5% NaCl (pH=2.5) solution. Corrosion process accelerate the failure due principally hydrogen induce and metal dissolution. To perform a good qualification and quantification of the mode of failure is better make an analysis of the amplitude (dB or mV) and the duration (µs) of the signal as a function of the cracking process. Result shows that the crack growing ratio (da/dN) decreases as increases the R ratio in air and this reduction is most critical in corrosion environment. The Crack initiation was characterized with signal below 70dB and 1000µs at R=0.1 in air, significant reduction was observed in corrosion environment (45dB and 100µs). At R=0.7 the AE activity increases but maintain below of 60dB and 1000µs, and in air reduced below of

40dB with 200µs. The mechanics of failure at the crack initiation process with low R ratio combined with corrosion process is principally transgranular due to the hydrogen induced, which present a low AE activity. But if the load ratio is higher (low amplitude) the metal dissolution mechanics is dominant which is expressed with increasing of AE activity. The stable stage crack propagation presents a significant reduction in the activity of AE some reference this stage knows as dormant stage.

[Engineering-06]

Chaves, Arlex, UPR-MAYAGUEZ; Rinaldi, Carlos, Dept of Chemical Engineering, UPR Mayaguez

Experimental and Theoretical Study of Suspensions of Magnetic Nanoparticles in an Annular Gap Subjected to a Rotating Magnetic Field

The flow of a ferrofluid, a suspension of magnetic nanoparticles in a Newtonian fluid, between two concentric cylinders subjected to a rotating magnetic field has been investigated by various researchers for the past thirty years. The consensus in the literature, based on analysis of the ferrohydrodynamic equations, is that when both cylinders are held fixed there should be no flow in the bulk of the annular gap. Experimental observations of a velocity profile at the ferrofluid-air interface are ascribed to interfacial magnetic stresses, rather than to a bulk flow. Direct measurements of the bulk velocity profile have been lacking because the opaque nature of the ferrofluid precludes usage of standard flow visualization methods. We have applied an asymptotic solution scheme to the ferrohydrodynamic equations and shown that bulk flow is indeed expected when higher order terms of the solution are taken into account. The analysis predicts bulk flow of ferrofluid in the direction of field rotation. Predictions for the torque on the inner cylinder were found to be in agreement with experimental measurements of torque for three different aspect ratios of inner to outer cylinder radii (γ) with various dilutions of a water based ferrofluid. An ultrasound velocity profile measurements technique was used to obtain the first measurements of the bulk flow of the ferrofluid in the annular gap.

[Engineering-07]

Davila, John, UPR-MAYAGUEZ; Acosta, Felipe, Civil Engineering and Surveying, UPRM; Pando, Miguel, Civil Engineering and Surveying, UPRM

Mechanical Behavior of Concrete Filled FRP Tubes Under Compresion Load

Concrete filled fiber reinforced polymer (FRP) tubes are an efficient alternative to be used as structural elements. In order to utilize them with a suitable level of confidence, a precise tool to predict their mechanical response is required. However, the majority of the models available for this purpose are limited. In this investigative work a non-linear finite element model is implemented to predict the response of concrete filled FRP tubes under axial

compression load. The results of this model are compared with those obtained from the experimental program for the study of this system and its constituents. With a simple geometry and the experimental calibration of conventional constitutive models, the proposed model allows to predict adequately the Force vs. Strain response, overcoming deficiencies observed in other models for the representation of the volumetric response.

[Engineering-08]
Duarte, Julio Martin, UPR-MAYAGUEZ; Velez-Reyes, Miguel, Electrical and Computer Engineering, UPR Mayaguez; Sapiro, Guillermo, Electrical and Computer Engineering, Univ. of Minnesota

Multi-Scale Smoothing, Segmentation, and Registration of Hyperspectral Imagery

An algorithm for smoothing and segmenting hyperspectral imagery based on the scale-space concept is proposed. A discrete scale-space representation of the image is obtained by anisotropic diffusion, governed by a discrete Partial Differential Equation (PDE). The PDE is solved using Algebraic Multigrid (AMG), a state of the art numerical technique that provides a scalable and very accurate solution to the PDE, and at the same time generates a pyramid of coarser versions of the image. The pyramid obtained constitutes a discrete scale-space representation of the image, with the original image at its base. As the image is coarsened, spectral-spatial statistics or geometric (moments of inertia) can be gathered, increasing the separability of the different regions in the image. The top layers of the pyramid consists of pixels that are representative of different regions in the image and with the statistical information gathered from those regions, the image can be segmented in a top-down process that starts with the representative pixels as seeds. The scale-space representation of the image, its segmentation and the statistic/geometric information gathered can be used to perform object-based classification and registration, with expected improved performance over traditional pixel-based methods.

[Engineering-09]
Gerbaudo, Guillermo, UPR-MAYAGUEZ

Developing Insurance Solutions Software for Natural Hazard Loss Estimation - Multilevel Input Data

In recent years, efforts to better understand economic consequences of catastrophic events have resulted in a number of computer programs that are best exemplified by the well known HAZUS software from the Federal Emergency Management Agency. HAZUS implements a multi-hazard loss estimation methodology that focuses on big picture solutions to regional problems. It has proven valuable when used within the framework specified by the program. This framework, however, is not ideally suited to predict loss-

benefit ratios for individual structures of the types used by insurance industries. There are several commercial insurance programs, each suffering from their own model limitations and with closed source codes hindering industry wide contributions. The focus of this research is on the methodology by which basic insurance solution software may be developed and implemented to meet the societal and commercial needs for regulating and writing the policies issued to individual home owners.

This poster describes the input data and default assumptions required to perform the multi-hazard risk analysis with the proposed methodology implemented in our program. The input data required by the computer program to do the calculations is structured in three levels, depending on the user expertise and the extent by which the input data may be generated. The investigation requirement ranges from a basic inquiry to an exhaustive investigation. Then for each level of investigation the user could perform a complete analysis but the lower the level of investigation the higher the uncertainty in results.

[Engineering-10]

Lammoglia, Victor, UPR-MAYAGUEZ; Acosta, Felipe, Ingenieria Civil, UPRM; Pando, Miguel, Ingenieria Civil, UPRM; Cain, Jason, Materials Science, VirginiaTech, Lesko, Jack, Materials Science, VirginiaTech; Case, Scott, Materials Science, VirginiaTech; ,

Durability Considerations of Concrete-filled Fiber-Reinforced Polymer (CFFRP) Tubes Subjected to Prolonged Hygrothermal Conditions

Deep foundations for bridges are traditionally made of reinforced concrete or steel which makes them susceptible to degradation when exposed to harsh marine environment. Durability issues of the traditional piles have lead to high repair and replacement costs in many US state and federal highway agencies. Consequently, there has been interest in investigating the use of more durable alternative piles such as composite piles. One of the composite piles under investigation consists of concrete-filled fiber-reinforced polymer tubular piles (CFFRP). CFFRP piles are fabricated by simply pouring concrete inside a FRP composite tube. The FRP tube provides tensile and flexural reinforcement, acts as a formwork during pile fabrication, and protects the concrete from degradation due to environmental exposure. The concrete infill primarily provides compressive strength to the element. These structural elements, when used as piles are typically subjected to both axial and bending loads. The use of CFFRP piles in bridge applications is relatively recent; therefore the amount of long-term durability data is limited. This poster summarizes durability data on CFFRP piles from ongoing work at Virginia Tech and the University of Puerto Rico, Mayagüez. The work carried out to date has detected strength and stiffness degradation of CFFRP tubes when subjected to hygrothermal conditions for extended periods of time.

[Engineering-11]
Masalmah, Yahya M., UPR-MAYAGUEZ

Unsupervised Unmixing Of Hyperspectral Images

This research presents an approach for simultaneous determination of endmembers and their abundances in hyperspectral imagery using a constrained positive matrix factorization. The algorithm presented here solves the constrained PMF using Gauss-Seidel method. This algorithm alternates between the endmembers matrix updating step and the abundance estimation step until convergence is achieved. Preliminary results using a subset of the Enrique Reef image data are presented. These results show the potential of the method to solve the unsupervised unmixing problem.

[Engineering-12]
Mondragon, Maria Victoria, UPR-MAYAGUEZ; Luis A. Godoy, UPR Mayaguez, Engineering

Computer Simulation of Interfase damage in composites

The interface between the fiber and matrix in a composite material plays a fundamental role in the performance of a composite component. One of the critical damage situations in composites does not occur in the matrix or in the fiber but in the transition region between them. Deterministic computational analysis is presented in this work for fiber glass-epoxy composites, and the results are compared with those obtained from the technical literature[1]. The problem is modeled using a finite element discrimination, using the general purpose program ABAQUS. A representative volume element (RVE) is modeled by two dimensional finite elements, in which symmetric conditions are applied in part of the edges of the cell, whereas the local stress is applied in the other edges of the cell as a load. The material properties are taken from the literature. Two models of RVE are presented, one with a perfect interface; and a second model with damage in the interface. The specific interface damage considered in this work takes the form of a bubble air on a thin layer of the interface. The results show that the tangential stresses are severely modified by damage. Parametric studies on the incidence of the thickness of the interface layer and on the volume fraction of bubbles are reported. This work is a first step towards a more comprehensive analysis of damage in composites due to environmental aging.

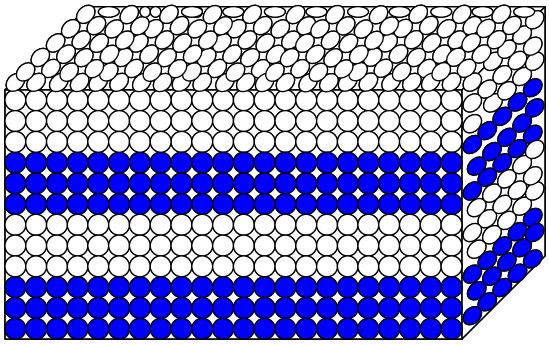
[1]. Kaminski M. M (1969), Computational mechanics of composites materials: Sensitivity, randomness and multi-scale behavior, Springer, London

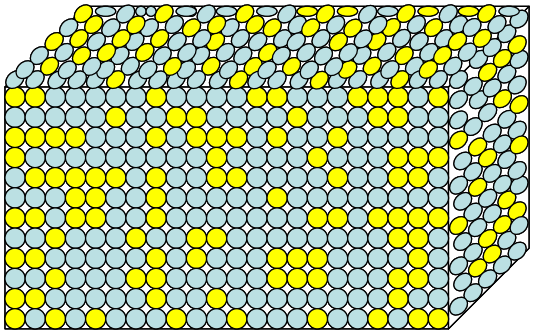
[Engineering-13]

Obregón, Luis Guillermo, UPR-MAYAGUEZ; Velázquez Figueroa, Carlos, Chemical Engineering, University of Puerto rico Mayaguez Campus

Measurement And Simulation Of The Concentration Profile Of Binary Mixtures Of Powders When Flowing Between Flat Plates With Rough Surfaces

In recent years, there has been a great interest in understanding the behavior of granular materials as they are used in industry in many engineering processes such as mixing. To obtain a perfect powder mixing it is necessary to understand the flow behavior of particles which is done using concepts of fluid flow that include mass and momentum balances with constitutive equations containing such material characteristic as friction angle and particle density. The objective of this project is to simulate the concentration profile of the combination of two powders to predict the degree of mixing when generating flow of powder between flat plates with rough surfaces. To achieve it, a new term in the constitutive equation will be used which is the interparticle force between the particles of the different components and then by means of the theory of mixture or theory of interacting continua with the governing equations, the entire system will be modeled. This simulation will be compared with the results found with another method of simulation that use Discrete Element Method and with the results acquired with experimental data obtained when mixing two different powders in an open box with movable walls. Preliminary experiments run with the same mixing time for different distribution of particle sizes have been done and the behavior of the flow has been different in each of them causing different degrees of mixing. This kind of behavior that depends of the characteristic of the materials will be explained at the end of this study.





[Engineering-14]
Olaya, Lilia, UPR-MAYAGUEZ; Sandra Pedraza, Department of Mechanical Engineering - University of Puerto Rico; Carlos Baez, Department of Mechanical Engineering - University of Puerto Rico, O. Marcelo Suarez, Department of Sciences of Engineering and Materials - University of Puerto Rico

Effect Of Directional Heat Flow On The Solidification Characteristics Of Aluminum Boron Copper Composites

A directional heat flow set up was used to study microstructure development and other characteristics of aluminum matrix composites containing 1-5wt.% Cu and 1-5 wt.% B, as directionally solidified. Microstructural parameters such as grain size, secondary dendritic arm spacing and phases present were assessed as well as cooling curves of the solidifying composites as a function of the position of the solidification front. Characterization techniques used included atomic force microscopy, optical microscopy assisted by image analysis,x-ray diffractometry, thermal analysis (DTA) and microhardness measurements. The directionally solidified composites presented larger volume fractions of diborides on the water chilled bottom (first stage of the specimen solidification) and a consequent variation of hardness throughout the composite specimen. The role of the diborides on the aluminum crystallization and resulting copper microsegregation upon solidification was also evaluated and discussed.

[Engineering-15]
Padilla, Yeira, UPR-MAYAGUEZ; Moses N. Bogere, University of Puerto Rico-Mayaguez Campus; Kimberly L. Ogden, University of Arizona- Tucson, AZ

Development of a Filtration and Biotreatment Scheme to Recycle Copper (II) Chemical Mechanical Polishing Wastewater

The growth in urban centers, improvement in quality of life and manufacturing activities have led to increased consumption of potable and process water. Currently, most of the used water in urban centers ends up at wastewater treatment facilities. At the industrial scale, only part of the water is recycled. Water reuse and recycling should be part and parcel of an efficient water resources management scheme. To recycle most of the used water, it is imperative to develop a rapid and efficient technology to treat secondary wastewater-treatment effluents. Almost all local communities within the public works system now mandate secondary wastewater treatment. A combination of rapid mass exchangers, filtration combined with biotreatment, followed by disinfection by irradiating the treated water with UV light can be optimized to treat secondary wastewater effluents to produce recycled water.

This research project attacks the problem of treating Copper Chemical Mechanical Planarization (CMP) wastewater streams containing a mixture of organics, copper, and silica or alumina nanoparticles. CMP is a critical step in integrated circuit (IC) device manufacturing. CMP and post-CMP cleaning

processes account for 30-40% of the water consumed by IC manufacturers and produce large quantities of wastewater. The overall benefit and motivation for this study is to explore the possibility of water reuse in semiconductor and biotechnology industries. Water purity and wastewater minimization is of importance to both industries. Thus, there is a need to develop a rapid and efficient treatment system that can be sustained. The mass exchangers separate particulates from the water before biotreatment.

[Engineering-16]
Quispitupa, Amilcar, UPR-MAYAGUEZ; Basir Shafq, General Engineering Dept, UPR Mayaguez

Effect of Hydrogen and Hold Time on the Fatigue Lifetime of Ultra High Strength Aircraft Structural Steels

High performance ultra high strength AF1410 steel used for critical marine and aerospace structural components were reported to be very susceptible to environmental hydrogen attack because its microstructural characteristics. Fatigue lifetime of model AF1410 steel as a function of fatigue hold-time (time expended at peak loads) and type and severity of environment is presented. Results indicate significant reduction in lifetime as a function of rising hold time for specimens charged with hydrogen, while a parabolic trend was observed in the case of specimens tested in air and in the presence of simulated marine environment. Compared with baseline tests in air, a gradual reduction in lifetime was observed as a function of increasing concentration of hydrogen in the specimens. Micrographic, AFM and SEM analysis is performed to study the various aspects of AF1410 lifetime and in order to observe the changes in fracture modes due to hydrogen effect.

[Engineering-17]
Realpe, Alvaro, UPR-MAYAGUEZ; Velazquez, Carlos, Dept of Chemical Engineering, UPR Mayaguez

Agglomeration Modeling Of Small And Large Particles By A Diffusion Theory Approach

The interaction between the particle and binder layer during the wet granulation process is an important factor in the agglomeration of particles. This interaction has been modeled by a force balance acting on the particle where binder's viscous force increases the strength of liquid bridge and facilities the particle agglomeration. Currently, the binder viscosity, size particle and the ratio between particle sizes (monodisperse and polydisperse) are not considered to develop the kernel coalescence of population balance equation (PBE) which makes difficult the modeling of growth kinetics. In this work, an agglomeration kernel based on Brownian movement of small particles in the binder layer and binder's viscous forces was used to model analytically the wet granulation

process of pharmaceutical powders in a laboratory-scale high shear mixer. Considerations no-stationary and pseudo-stationary were suitable to describe growth kinetics of the two stages (fast and slow) observed in wet granulation process of pharmaceutical powders. The model predicts the change of particle size distribution (PSD) during wet granulation by including the initial material properties such as binder viscosity and powder particle size. Also, the binder amount predominant during the fast granule growth is considered indirectly in the variable of binder layer. Simulation results using the theoretical kernel were in good agreement with experimental data

[Engineering-18]
Rodriguez, Valerie, UPR-MAYAGUEZ

Graphical Tool for the Analysis of Response Surface on Design of Experiments: A Three Dimensional Approach

Both, general and statistical softwares with DOE tools are limited in their capability of allowing the user a full control on independent factors representation. They are trustworthy on statistical analysis, but lack graphical interfaces that support DOE's powerful capabilities. This project presents the development of a software application that provides a three-dimensional approach for the analysis of response surface on Full Factorial, Box-Behnken, and Central Composite design of experiments. The application was developed in Matlab programming software. The tool will be demonstrated using available scenarios and with a case study from an electronic company.

[Engineering-19]
Rodriguez, Radhames, UPR-MAYAGUEZ; Gutierrez, Gustavo, Mechanical Engineering, UPRM, Mayaguez

Conductivity Measurent Of Ferrofluid Using Transient Hot Wire Method

Thermal conductivity is an unpredictable property of the ferrofluids, because the existing models can not explain the real behavior of such fluids. The lack of reliable correlations makes experimentation the way to determine the observed enhancement in thermal conductivity of ferrofluids. The transient hot wire method is an experiment in which the thermal conductivity is obtained by measuring a temperature change, respect to the time, in a thin wire caused for a constant current passing all the way through it. Some advantages of this method are the almost complete elimination of natural convection effects, its fast implementation and its high accuracy. For calibration purposes, a thermal conductivity measurement of a known fluid like water, toluene acetone and heptane is carried out. The transient hot-wire method is used to measure the thermal conductivity of different water-based ferrofluids and oil-based ferrofluids; obtaining until 24% of increase in the thermal conductivity of the ferrofluid respect

to the base fluid. The influence of the volumetric concentration of the particles in the fluids is tested varying the volumetric concentration from 0.4% until 3%.

[Engineering-20]
Torrens, Juan, UPR-MAYAGUEZ; Alamo Loyola, Alberto, Civil Engineering and Surveying, Univ. of Puerto Rico at Mayaguez

Roadway Design Elements Related to Motorcycle Crashes in Puerto Rico

The amount of registered motorcycles, including motor scooters, in Puerto Rico has increased from 33,000 to 75,000 between the years of 1997 to 2005. The frequency of injury and fatal motorcycle-related crashes has also increased significantly through the same period. The frequency of motorcycle crashes in the island almost doubled, from 2,089 to 4,068 crashes, during the years 2002 to 2004.

Highway crashes happen because of several interrelated factors; of which the vehicle, the roadway design, and the driver are the main ones. This study is directed towards analyzing the safety relationship between motorcycles and the roadway characteristics. The purpose of this study is to perform a statistical analysis of crash contributory factors and the identification of the main roadway design elements that are related to motorcycle crashes in Puerto Rico.

The crash database of the Puerto Rico Highway and Transportation Authority was used to identify and analyze the factors, related to roadway design, driver characteristics, and crash circumstances, that mainly contribute to motorcycle crashes in Puerto Rico. Interviews to motorcycle users, Police officers, and Medical Emergency personnel were also performed to identify their perception of the relationship between road design, motorcycles, and highway safety. The results of this study will assist transportation and highway safety agencies to reduce the frequency and severity of motorcycle crashes by implementing engineering safety improvements in their road design and maintenance processes.

[Engineering-21]
Veguilla, Ricardo, UPR-MAYAGUEZ; Nayda Santiago, Electrical and Computer Engineering, University of Puerto Rico, Mayaguez Campus

WALSAIP-VTE: A Visualization Tool For Environmental Monitoring And Analysis

The application of computing technology to monitor and study the environment is an active area of research. At the Electrical and Computer Engineering Department of the University of Puerto Rico, Mayagüez, we are developing the Wide Area Large Scale Automated Information Processing (WALSAIP) Project. The goal of the WALSAIP Project is to provide a framework for the distributed and automated information processing of information arriving from physical sensors for water-related ecological and environmental applications. In this work, we present the WALSAIP Visual Terrain Explorer, a

terrain visualization tool which will support the exploration of georeferenced data obtained from physical sensors.

In order to support the interactive, visual exploration of terrain-related data, the visualization tool must be capable of rendering terrain geometry and interactive framerates. However, constructing such visualization from high resolution terrain geometry and satellite images for common personal computers presents considerable challenges. The large size of the data and the computationally intensive algorithms involved in the rendering process generally surpass the capabilities of common personal computers.

To support interactive visualization of potentially massive terrain data sets, the visualization tool employ level-of-detail (LOD) rendering optimizations, exploits hardware acceleration available in common computers via the OpenGL graphic library and leverage distributed computing and storage resources for terrain data management and distribution.

In this work we will be presenting the technical aspect associated with the development of this visualization system and the results obtained.

[Engineering-22]

Velasco, Andres Felipe, UPR-MAYAGUEZ; Hernandez-Rivera, Efrain, Mechanical Engineering Department, University of Puerto Rico at Mayagüez; Perales-Pérez, Oscar Juan, Department of Engineering Science & Materials, University of Puerto Rico at Mayagüez; Tomar, Maharaj S., Physics Department, University of Puerto Rico at Mayagüez

Synthesis Of Copper Nanoparticles For Synthesis Of Nanofluids With High Thermal Conductivity

Recent work with nanoparticles-bearing fluids, so called nanofluids, has revealed greater values of thermal conductivity when compared to the solvent alone (generally a fluid exhibiting moderate thermal conductivity). This particular behavior is of great technological interest since the performance of many machinery and devices depend strongly of the capability of heat management. Moreover, current materials are reaching their practical limit. From all nanofluids, those that seem to display the best thermal properties are the ones containing metal nanoparticles. Copper, silver and gold-bearing nanofluids display excellent thermal properties. In this ongoing research, copper nanoparticles were synthesized in aqueous phase using hydrazine as the reductant agent. Copper is a material commonly used for thermal applications, possesses a high thermal conductivity and relatively low cost. So far, we have determined the optimum synthesis conditions of copper particles synthesis. Growth-restricted crystal formation will be attempted by using Sodium dodecyl sulfate, (SDS), as the stabilizing agent.

Environmental Sciences

[Environmental Sciences-01]
Alamo, Luis, UPR-MAYAGUEZ; Roman, Felix, Chemistry, UPR-Mayaguez; Perales-Perez, Oscar, General Engineering-Materials Science and Engineering, UPR-Mayaguez

Sorption Of Ethylbenzene, Toluene And Xylene Onto Crumb Rubber From Aqueous Solutions

Waste tires crumb rubber was used to remove ethylbenzene (E), toluene (T) and xylene (X) from aqueous solutions at room temperature. Concentrations of ETX were quantified by GC-MS. Sorption of ETX compounds using different concentrations (10.0, 5.0 1.0, 0.5 and 0.1 g/L) of crumb rubber mesh 14-20 were investigated at pH 1.5 and 6.0. The removal efficiency was dependent on solution pH and crumb rubber concentration. At pH 6 and 10 g/L of crumb rubber up to 99, 95 and 77% of xylene, ethylbenzene and toluene, respectively, were removed from starting 30 mg/L solutions. The corresponding uptake capacities were 55, 48 and 24 mg/g rubber. A 5 % drop in the efficiency removal of ETX compounds by crumb rubber was observed when the pH was 1.5. The sorption capacity of crumb rubber was xylene > ethylbenzene > toluene. The higher concentrations of crumb rubber enhanced its uptake capacity for ETX compounds.

[Environmental Sciences-02]
Burgos, Sofia, UPR-RIO PIEDRAS; Burgos-Caraballo, Sofía, Biology, UPR-RP; Caceres, Rita, Biology, UPR-RP; Ramírez, Alonso, Biology, UPR-RP.

Effects Of Land Use On Benthic Biofilm Metabolism In Tropical Streams In Puerto Rico

Benthic biofilm metabolism in streams can be strongly affected by watershed land use. As riparian vegetation cover decreases, a shift in metabolism occurs towards high primary production. We measured biofilm metabolism in nine low-order streams in a watershed under increasing development pressure in Puerto Rico using closed sealed metabolic chambers. Three streams were selected within the three major land use types in the watershed: forest and low intensity agriculture, mix agriculture and rural communities, and suburban land uses. We hypothesized that the main impact of land use was related to increases in light availability with a change from heterotrophic to autotrophic metabolism. Results supported this hypothesis, showing that streams with riparian vegetation had low nutrient levels and high

respiration rates. In contrast, those in mix agriculture and suburban land uses had high nutrient levels and high rates of primary production. Overall, our study shows that benthic biofilm metabolism reflects the land use type on the watershed and that rates are mainly related to changes in riparian vegetation cover and in light availability. Assessment of biofilm metabolism could be a useful tool in understanding anthropogenic impacts to lotic ecosystem function.

[Environmental Sciences-03]

Cardona, Vanessa, UPR-MAYAGUEZ; Cruz Esteves Nelly,; Vega Alvarado Lissette,; Rios Velazquez Carlos; Biology Dept, University of Puerto Rico-Mayaguez

First report of Vogesella sp. in Puerto Rico

In the microbial world, pigments are one of the most interesting traits because they may provide physiological tools allowing competitiveness by protecting the microbes against light damage and oxidative environments. Blue pigmented bacteria (BPB) are rare and the pigment has been proposed biotechnologically as biomarkers for metal contaminated environments. The main purpose of this research is to characterize the first blue pigmented bacteria reported for Puerto Rico, and isolated from a soil sample. The morphological and microscopic analysis of the PR-BPB performed by differential staining and Scanning Electron Microscopy indicated that it is a gram-negative rod of 1.0 – 2.0 um in length. In order to determine its optimal growth conditions, PR-BPB was incubated at different temperatures. It was observed that the optimal growth was obtained at 37oC, but the pigment was only produced at 23°C. The *in silico* analysis of the amplified 16S rDNA suggested that that PR-BPB belongs to the *Vogesella* genus, specifically *Vogesella indigifera*. When PR-BPB was physiologically and biochemically compared with activities described by Grimes et al., in 2005, PR-BPB showed differences only in the indole test, where was unable to degrade tryptophan. PR-BPB pigment analysis by whole cell spectra showed a characteristic absorption peak at 430 nm**,** suggesting that it may be indigoidine.

[Environmental Sciences-04]

Figueroa, Debora, University of New Hampshire; Ortiz-Zayas, Jorge R., ITES, University of Puerto Rico Rio Piedras Campus; McDowell, William H., Natural Resources, University of New Hampshire

Contributions from Waste Water Treatment Plants to Nutrients, Discharge, and DOC in Streams in the Northeastern Region in Puerto Rico

Waste water treatment plants (WWTP) in Puerto Rico continuously discharge their effluents to streams, changing downstream chemistry and posing a risk to riverine and estuarine organisms. Impacts on receiving waters will vary depending on the nutrient load and hydrologic contribution made by WWTP

effluents. Effluent discharges are regulated based on organic load contributed to receiving waters, and thus largely refractory organic matter should be found in WWTP effluents. Some reduction in nutrient loads occurs with secondary and tertiary treatment, but the extent of this nutrient reduction is not well known. Similarly, the extent to which these WWTP contribute to stream base flow is also unknown. This study evaluates three WWTP (two secondary and one tertiary) and the amount they contribute to stream nutrients, discharge and DOC by using a mass balance approach. Water samples are being collected to analyze the contribution of effluent to stream phosphate, nitrate, ammonium, DON, and DOC flux. The biodegradability of organic matter is being calculated by measuring specific UV absorbance and by measuring biodegradability directly.

[Environmental Sciences-05]

Hernandez, Pablo J, UPR-RIO PIEDRAS; Perez-Reyez, Omar, Biology Department, University of Puerto Rico, Río Piedras Campus; Ramirez, Alonso, Biology Department, University of Puerto Rico, Río Piedras Campus

Diversity and abundance of stream benthic insects among rivers in Puerto Rico.

Little is known about the abundance and diversity of aquatic insects that inhabit the freshwater system of the island of Puerto Rico. The main questions that this study addresses are: a) describe and report families of aquatic insect that inhabit the rivers of the island. b) what is the relationship among insect families and their habitats?; c) which group of insects could be used as a bio-indicator?. We identified which insect family were more vulnerable to pollution, in order to use them as bio-indicators. During the months of March, April and August of the present year we collected aquatic insects from several rivers located around the island. In each river we collected samples from different micro-habitats associated to the riffles. The rivers associated to protected lands presented more richness and evenness of aquatic insect families. Also, in those rivers we observed the *Elmidae* (Coleoptera), about three individuals per square meter, and it was not found on the rivers associated to the non-protected lands. This coleopteran family can be use as a good bio-indicator in the Puerto Rican rivers.

[Environmental Sciences-06]
Irrazabal, Maik, UPR-MAYAGUEZ; Florian, Vivian, University of Puerto Rico at Mayagüez; Hernandez, Samuel, University of Puerto Rico at Mayaguez; Briano, Julio, University of Puerto Rico at Mayaguez

Effect of Environmental Parameters on the Chemical Signature of TNT in Soil, Validation of Numerical Simulations

As part of a large research program aiming to the development of chemical sensor for detecting land mines, we have studied the fate and transport of TNT subject to different ambient parameters. The space and temporal concentration profiles of TNT, and its degradation compounds have been measured using soil tanks. The following ambient parameters were controlled to emulate environmental factors: water content, temperature, relative humidity, and UV-VIS radiation. A series of soil tanks were kept under controlled conditions for longer than a year and sampled periodically at the surface. After several months, all tanks were sampled vertically and disposed of. Chromatographic techniques (GC-μECD) with direct injection were used for the analysis of the samples. Of particular interest is the presence of several degradation compounds, as time evolves, responding to the ambient parameters imposed. The vertical concentration profiles of the several chemicals found, gives an interesting view of the degradation process as well as of the transport mechanisms. The results agreed with our computer simulations, and are being used to validate previous numerical analyses.

[Environmental Sciences-07]
Martinez, Yazmin, UPR-RIO PIEDRAS

Beach Erosion: Causes and Solutions

Nearly 70% of the world's beaches are currently in a state of erosion. Entities such as the U.S. Army Corps of Engineers have for years advocated the hardening of shores suffering from erosion, in order to protect valuable land. Unfortunately, this practice has led to the widespread loss of dozens sandy beaches in Puerto Rico. In many coastal communities, the beaches represent the heart of the economic engine; therefore the protection of the beaches themselves (as opposed to the land) is of vital importance. We submit that Mother Nature has already designed the ultimate form of protection for beaches: reef structures. Hydrodynamic modeling software (MIKE21) from the Danish Hydraulic Institute will be used to model the effects of various configurations of structures designed to function as artificial reefs to protect beaches against erosion. It is hoped to determine whether this type of solution is reasonable for the various combinations of winds, waves and beaches found around Puerto Rico.

[Environmental Sciences-08]

Melendez, Maria Margarita, UIA-BARRANQUITAS; Nuñez Figueroa, Damaris, Ciencias y Tecnilogia, Universidad Interamericana de Puerto Rico, Recinto Barranquitas; Negrón Berrios, Juan A., Ciencias y Tecnologia, Universidad Interamericana de Puerto Rico, Recinto de Barranquitas

Genes y Bioacumulación de Plomo en Bryophyllum pinnatum

Debido a la intensa actividad antropogénica, la concentración de metales pesados en los suelos, el agua y la atmósfera han aumentado significativamente, alterando los ecosistemas acuáticos y terrestres. En el intento por preservar nuestro ambiente, se han implantado una serie de técnicas con el objetivo de remediar las áreas contaminadas con estos metales. La fitoremediación es una alternativa potencialmente efectiva y ecológicamente viable, pero su avance se ha retrazado debido principalmente a dos razones: 1) se desconocen los mecanismos de incorporación, movilización y metabolismo de estos metales en las plantas. 2) falta de especies vegetales que puedan utilizarse como modelos de estudio y aplicación de acuerdo al ecosistema contaminado. *Bryophyllum pinnatum* (conocida en Puerto Rico como Yerba Bruja) es una especie tropical de rápido crecimiento que se encuentra ampliamente distribuida en los ecosistemas tropicales.

En este trabajo, hemos micropropagado asépticamente a *Bryophyllum pinnatum* y se a determinado mediante espectroscopia de absorción atómica que dicha planta es capaz de hiperacumular plomo. El mecanismo en el nivel molecular de esta hiperacumulación de plomo y otros metales pesados en plantas no se ha determinado, sin embargo, se sabe que proteínas como las metalotioneínas (MTs) participan en la homeostasis de estos metales. En las plantas, estos genes han sido estudiados con mayor detalle en *Arabidopsis thaliana*. Basado en el genoma de *Arabidopsis thaliana* hemos diseñado oligonucleótidos que nos han permitido identificar un segmento del genoma de *Bryophyllum pinnatum* compatible con secuencias publicadas de animales y plantas de genes de MTs. El próximo paso de este trabajo consiste en completar la clonación de dicho gen en *Bryophyllum pinnatum* e investigar la posible correlación entre la expresión genética MTs y la hiperacumulación de plomo.

Geosciences

[Geosciences-01]
Cuevas, David, UPR-MAYAGUEZ; Sherman, Clark E., Dept of Marine Sciences, UPR-Mayaguez; Ramirez, Wilson, Dept of Geology, UPR-Mayaugez; Hubbard, Dennis, Dept of Geology, Oberlin College, Oberlin, Ohio

Species distribution, coral growth and sedimentation in a Mid-Holocene coral reef: Cañada Honda, Dominican Republic

Concerns about the decline of modern coral reefs have led many scientists to look into the fossil record in an effort to understand coral-reef development prior to the onset of anthropogenically-induced disturbance. The Mid-Holocene Cañada Honda fossil reef, located in SW Dominican Republic represents a unique opportunity to examine a coral reef that thrived in a high-sedimentation environment before any major human settlement on Hispaniola. The excellent preservation allows detailed examination of its community structure over an extended time period. Quantitative assessments of coral abundance, species richness and sediment distribution were obtained throughout most of the reef outcrop using quadrats along vertical transects. Measurements of coral-growth rates, and sediment composition were also conducted to characterize their variability within the reef. Twenty-two coral species were identified in the outcrop. Four coral biofacies can be recognized as in many modern coral reefs. Sedimet-tolerant species such as *Siderastrea siderea* and *Montastraea faveolata* were the predominant corals of the community which is indicative of siltation stress. Horizontal transects along paleoreef surfaces show a low diversity assemblage of sediment resistant corals with nearly 40% coral coverage. Measured growth rates in the corals *Siderastrea siderea* (0.2-0.4 cm/yr) and *Montastraea faveolata* (0.09-0.44 cm/yr) are relatively low compared with growth rates in corals from other sites, and are consistent with high sedimentation. The reef sediment is characterized by less than 10% non-carbonate material. Neogene limestones located north of the study site are believed to be the source of most of the incoming carbonate sediment on the reef. Despite the conditions of high sedimentation the coral reef persisted over an extended period of time. It is possible that even though sedimentation was high, this occurred sporadically allowing time for the reef corals to respond and grow back, in such a way that they were able to “keep-up” with sedimentation.

Life Sciences

[Life Sciences-01]
Almeda, Carlos A., UPR-HUMACAO; Ayala del Rio, Hector L. PhD, Biology Department , UPR Humacao

Efecto De La Temperatura De Crecimiento En La Estabilidad Del Genoma De Psychrobacter Arcticus 273-4

Psycrobacter articus 273-4, es un microorganismo psicroactivo que crece rápidamente a temperaturas por debajo de los cero grados Celsius. El genoma de este microorganismo es uno conocido y en el cual se han identificado un sin numero de secuencias conocidas como transposones y secuencias de inserción. Estas secuencias se creen están asociadas con rearreglos genómicos aunque esto continua siendo un enigma. La técnica de rep-PCR, que genera una huella genética basada en secuencias repetidas, utilizando cebadores BOX es una que se ha utilizado para diferenciar microorganismos del mismo genero pero diferente especie. En nuestro caso, el cebador BOX se utilizó para medir el efecto de la temperatura en rearreglos genómicos basados en cambios en el patrón de la huella genética de la cepa *Psychrobacter arcticus* 273-4. Para esto se creció el organismo *Psycrobbacter articus 273-4 a* -6º, 4º, 17º y 22º C. Luego de realizada la extracción y purificación del DNA de cada uno de los cultivos, se amplificó utilizando la técnica de rep-PCR con el cebador de BOX. Nuestros datos experimentales revelaron patrones de bandas idénticos para organismos crecidos a temperaturas de -6º, 4º, 17º y 22º C generando entre 15 y 20 bandas diferentes. Esto sugiere que a pesar de la alta cantidad de elementos mobiles en el genoma de Psychrobacter, estos no afectan la estructura del genoma.

[Life Sciences-02]
Araujo, Felix, UPR-RIO PIEDRAS; Araujo Perez, Felix, University of Puerto Rico; Cotto, Yahdi, University of Puerto Rico; McMillan, W. Owen, University of Puerto Rico

Linkage Disequilibrium Mapping Of Wing-Colour Pattern Genes In Heliconius Butterflies

The purpose of this study is to assess the levels of linkage disequilibrium (LD) in two populations of *Heliconius erato* butterflies belonging to a Peruvian hybrid zone. Observing the extension of LD will allow us to get closer to the genes that are responsible for the wing-colour pattern in *Heliconius* narrowing-down the candidate loci with the possibility of identifying the genes involved in the generation of the wing-colour pattern in *Heliconius*. In addition knowledge of

how genomic variation is distributed in wild populations of *Heliconius* butterflies will be achieved. The proposed study is based on previous work were various genomic regions that are tightly linked to wing-color pattern genes in *Heliconius* were identified and primers were generated from them (Kapan, Flanagan et al. 2006). The same primer combinations are going to be used in this research project for amplifications of genomic regions from individuals that are part of two populations belonging to a Peruvian Hybrid zone. Amplifications will be cloned and sequenced followed by an assessment of the basic level of LD within them and also observation how the strength of LD is correlated with the length of the sequence. Finally a comparison between LD levels between the two populations belonging to a Peruvian Hybrid zone will be done.

[Life Sciences-03]

Benítez, Rafael J., UPR-RIO PIEDRAS; Jorge R. Ortiz Zayas, Instituto para Estudios de Ecosistemas Tropicales, Universidad de Puerto Rico-Río Piedras

The Effects Of Wastewater Effluents On The Metabolism Of Tropical Island Estuaries.

All around the world, anthropogenic activities have been affecting many estuarine processes like community metabolism and nutrient cycling. These impacts are particularly unknown in tropical developing islands. A study has been initiated to assess how different levels of wastewater treatment can affect the community metabolism of tropical estuaries in Puerto Rico. The proposed work will be conducted in three stratified estuaries in Northeastern Puerto Rico: Río Fajardo, Río Sabana, and Río Mameyes. Two of these estuaries (Sabana and Fajardo) receive different levels of treated sewage ranging from tertiary to secondary, while Rio Mameyes receives no direct sewage and thus represent a control system. The proposed research will improve the existing knowledge base and will assist in the management of these ecosystems.

[Life Sciences-04]

Chad, Lozada, UPR-MAYAGUEZ; Ballantine, David L., Dept. of Marine Sciences, University of Puerto Rico, Mayagüez

Molecular establishment of a new Champia species (Rhodymeniales, Rhodophyta) from Puerto Rico, Caribbean Sea

DNA sequence analysis and detailed morphological examination has resulted in the recognition of a new *Champia* species. The new species is virtually inseparable from *Champia salicornioides* in the field. However, when examined microscopically, the new species differs in having branches originating from septal regions as opposed to branching from internodal regions. Other subtle internal morphological differences separate the species as well. Molecular differences between *C. salicornioides* and the new species was confirmed using data from the small ribosomal subunit (18S) gene. The phylogenetic position of

the new species was also determined within the Champiaceae. The new species represents a sister taxon of *Champia salicornioides* with highly supported bootstrap values (99-100%) for all optimality criteria tested.

[Life Sciences-05]
Conde, Carlos, UPR-RIO PIEDRAS; Ortiz-Zayas, Jorge, UPR Rio Piedras, Institute of Tropical Ecosystems Study

Nitrogen Dynamics in a Tropical Cave Stream

Nitrogen transport and transformations along cave streams will have a direct and significant influence in karst surface streams, basin ecological processes and coastal water ecosystem. The current investigation documents nitrogen dynamics along a tropical cave stream that receives a constant input of nitrogen-rich organic material in the form of bat guano. In-stream relative composition and concentration of nitrogen species will be documented during one water year. Cave stream nitrogen assimilative and retention capacity, as well as the rate of nitrification and denitrification will be determine. Preliminary information suggests an efficient removal of nitrogen from the water column, while the documented relative composition of nitrogen forms suggests an optimun and efficient nitrification process.

[Life Sciences-06]
Espinosa, Daisy Y., UPR-RIO PIEDRAS; Ramirez R., Cuello, KA; Biology Dept., UPR Rio Piedras, Marti, L; Chemistry/Biology Dept, UPR Rio Piedras, Gomez, CM, Neurology Dept; University of Chicago, Lasalde-Dominicci, J A; Chemistry/Biology Dept, UPR Rio Piedras

Description of the Neuromuscular Degeneration in Transgenic Mice áV249F

Slow Channel Congenital Myasthenic Syndrome (SCCMS) constitutes a group of rare genetic disorders affecting neuromuscular transmission. This syndrome is a dominantly inherited disorder, caused by a point mutation that creates a delay in the closure of the muscular nicotinic acetylcholine receptor (AChR) in humans. We are studying the pathogenesis of the neuromuscular degeneration in transgenic mice, Mus musculus, with SCCMS caused by substitution of the amino acid valine for phenylalanine in the 249 position of the alpha subunit of the nicotinic AChR. The muscle strength of transgenic mice has been studied using the hanging wire test and the endplate degeneration has been assessed through confocal imaging using fluorescent neuromuscular markers. In brief, ACh receptors have been labeled using alexa 488 α-Bungarotoxin, in whole mounts of diaphragm and triangularis sterni muscles. Preliminary results suggest that the muscle strength of transgenic mice and wild type animals is very variable and that there seems to be no direct correlation between mutant animals and controls regarding muscle function. At the microscopic level, we have found that the number of endplates per section and

the area of endplates show no significant degeneration with respect to wild type mice. However, the fluorescence intensity for α-Bungarotoxin is diminished in transgenic animals when compared to wild type. These may be early signs of neuromuscular degeneration, but further experiments will assess the neuromuscular degeneration using electrophysiological methods.

This work was supported by NIH grants RO1GM56371-10, NCRR 1S0RR13705 and S06-GM08102-27 to JAL-D and 2RO1-N33202 to C.G.

[Life Sciences-07]

Flores, Keila, UPR-MAYAGUEZ; Rios-Velazquez Carlos

Photosynthetic Purple Non Sulfur Bacteria From Water Reservoirs Of Puerto Rico

Capacity to produce energy through photosynthesis, the ability to growth as chemoheterotrophs, or the aptitude to obtain energy by fermentation or anaerobic respiration are some of many features that describe Photosynthetic Purple Non Sulfur Bacteria (PPNSB). The habitat of this group of microorganism ranges from ponds and lakes where there is access to sunlight, surface water from streams, bogs, snow and hailstones. Their importance in bioremediation, biotechnology and hydrogen production makes them a well study group of bacteria. The main focuses of this study are the isolation and characterization of PPNSB from water reservoirs of Puerto Rico. This represents the first study of this group of bacteria in Puerto Rico. PPNSB were enriched incubating the water samples with selective media anaerobically in the presence of light. All the samples evaluated showed enrichment for PPNSB, and the candidates were purified and morphological characterized by micro and macroscopic analysis. The characterization was also complemented with standard biochemical test, carbon utilization profiles by Biolog and absorption spectra. Molecular analysis was performed through the amplification by Polymerase Chain Reaction (PCR) of the 16S rDNA and the gene encoding the M subunit of the photosynthetic reaction center (*puf*M). Ninety PPNSB candidates were isolated from 14 water reservoirs obtaining ten different morphotypes. Anoxyphototrophically grown cultures were pink to deep red and brown- greenish in color. Absorption spectra revealed that candidates contained bacteriochlorophylls *a* and *b* and the presence of photosynthetic machinery is suggest by positive amplification of *puf*M gene. Analysis of the 16S rDNA gene sequences revealed that the candidates are similar to *Rhodobacter sphaeroides, Rhodopseudomonas palustris* and unidentified photosynthetic bacteria.

[Life Sciences-08]

Godoy, Filipa, UPR-RIO PIEDRAS; Gao, Zhan, DPei, Zhiheng; Dept of Microbiology, New York University School of Medicine, Ley, Ruth; Gordon, Jeffrey, Center for Genome Sciences, Washington University in St. Louis, Pericchi, Luis, Dept of Mathematics, UPR Rio Piedras; Garcia-Amado, Maria, Michaelangeli, Fabian; Venezuelan Institute of Scientific Research IVIC,

The diverse and complex microbial community inhabiting the foregut of a South American Leaf-Eating Bird: the Hoatzin (Opisthocomus hoazin)

The hoatzin is a South American strict folivore, and the only known bird with crop microbial fermentation. We defined the crop microbial ecosystem by analyzing microbial SSU rRNA genes from crop contents of 6 adult animals. A total of 1232 bacterial sequences (from 6 animals) and 201 fungal sequences (from 3 animals) were obtained. Operational taxonomic units (OTUs), were defined by 99% pair-wise identity. Bacterial sequences clustered into 582 OTUs mostly belonged to Firmicutes (67%) and Bacteroidetes (30%), with a small proportion of 7 other phyla (Actinobacteria, Proteobacteria, TM7, Spirochaetes, Verrucomicrobia, Lentisphaerae and Aminanaerobia). Interestingly, we found more than 50% unclassified clones: 1 is a novel Order, 12 are unclassified Families, 480 are unclassified Genus, 345 unclassified Species and other clones resemble uncultivated groups and few known Species. The bacterial diversity coverage was 67% (Good's index) and richness estimations (Chao1 and ACE) suggest that at least 1700 phylotypes would be detected with continued sequencing from our samples. The bacterial community was more similar in lineage content to that of the cow rumen than to chicken intestines or rumen and intestines of other mammals (wild African ruminants, zebra, pig). Fungal sequences were highly diverse (Shannon index of 4.6), resulting in 122 OTUs (63% coverage). Fungi were mostly epiphytes of plants, with the exception of several *Cryptococcus* clones.

These results indicate that the hoatzin's crop is a unique fermentative digestive ecosystem that harbors diverse diet-related fungi, and a highly complex and diverse indigenous bacterial community with features similar to those of ruminants.

[Life Sciences-09]

González, José, UPR-RIO PIEDRAS; Colón-López, Daisy D., Biology Department, UPR-Río Piedras; Maurás, Kirla R., Biology Department, UPR-Río Piedras; Estrella, Luis A., Biology Department, UPR-Río Piedras, Martínez, Daviana, Biology Department, UPR-Río Piedras; Lázaro, María I., Biology Department, UPR-Río Piedras; González, Carlos I., Biology Department, UPR-Río Piedras

Translational Control Of Human Interleukin-3 Mrna By The Adenosine/Uridine Rich Element

Human interleukin-3 (IL-3) is a cytokine that stimulates the growth and differentiation of early lymphoid stem cells and has been implicated in cancer. IL-3 is a member of a class of transiently expressed mRNAs that harbor Adenosine/Uridine-Rich Elements (ARE) in their 3'-UTRs. These AREs play a role in post-transcriptional control by altering mRNA stability and/or translation. The regulatory effects of AREs are often mediated by specific ARE-binding proteins (ARE-BPs). To understand how the AREs and ARE-BPs in the 3'-UTR of the IL-3 mRNA regulate its expression, we constructed a series of firefly luciferase reporter chimeras harboring specific regions of the IL-3 3'-UTR. Transient transfection assays of HeLa cells harboring a luciferase-IL-3 3'UTR reporter construct showed a significant reduction in luciferase activity. Moreover, the presence of the IL-3 ARE further repressed the translation of the luciferase chimera. We also monitored the effects on translation of these 3'-UTR sequences in both rabbit reticulocyte lysates (RRLs) and translationally-competent HeLa cell-free extracts. IL-3 AREs can dramatically reduce the luciferase activity of the reporter construct in both in vitro translation systems. The reduction observed in luciferase levels is not due to an altered stability of the reporter mRNAs, as measured by RT-PCR. Electrophoretic mobility shift assays (EMSAs) demonstrated the formation of several protein complexes in the IL-3 3'-UTR regions. Together, these results provide evidence for ARE-dependent translational control of the human IL-3 mRNA. JAGF and DDCL are supported by PR-LSAMP. This work is supported by grants to C.I.G. (KO1 HL-04355-05, GM008102-3052, U54 CA96297-03, AABRE-P20 RR-016470 from NCRR, FIPI-UPR).

[Life Sciences-10]

Longo, Ana, UPR-RIO PIEDRAS; Burrowes, Patricia A., Biology, UPR-RP; Joglar, Rafael L., Biology, UPR-RP

Patterns of chytridiomycosis in Coqui frogs from El Yunque

Populations of six different species of *Eleutherodactylus* (coqui frogs) have been declining at El Yunque over the last 30 years and there is evidence

that links these declines to changing climatic patterns. In addition, chytridiomycosis, a recently emerged infectious disease in amphibians caused by a fungus (*Batrachochytrium dendrobatidis = Bd*), has been documented in at least four of 13 species of coqui frogs at El Yunque, Puerto Rico since 1976. We suspect that climate and disease may be playing a role in the prevalence of chytridiomycosis at high elevations, thus triggering amphibian declines. We studied populations of *Eleutherodactylus* at two different elevations at El Yunque, Palo Colorado Forest (661m) and Bosque Enano Forest (850 m), using mark and recapture, visual encounter and call survey methods. Tissue collected for marking purposes was also used for *Bd* diagnosis using molecular techniques. Prevalence of this disease among individuals varies from 0% - 100% (n=437) per month, and suggests a cyclic pattern of dry/cool–wet/warm climate-driven synergistic interaction between pathogen and host, that is being corroborated via *in-situ* laboratory experiments. Abundance data is significantly associated to levels of disease prevalence among populations, suggesting that even hardy species, like *Eleutherodactylus coqui,* may be at risk. Progress of this research is expected to enhance our understanding of the role of environmental factors on the biology of this pathogenic fungus, and the mechanisms that certain frog species may have to prevail in the wild.

[Life Sciences-11]

Loperena, Yaliz, UPR-MAYAGUEZ; Ruiz-Acevedo Alejandro, UPR-Mayaguez; Rios-Velazquez Carlos, UPR-Mayaguez

First report of Cryptococcus neoformans/gattii in trees in Puerto Rico

Cryptococcus neoforman/gattii complex are encapsulated yeasts that can be present in the environment, in pigeons droppings and trees detritus. The study of *C. neoforman/gattii* has great clinical importance because these yeasts can cause an asymptomatic pneumonia and meningoencefalities in both immunecompromised and immunecompetent patients. Almost all the studies related to the ecological niche of these yeasts in Puerto Rico have been performed in pigeon droppings. Since the Vancouver epidemic caused by *Cryptococcus gattii*, usually related to eucalyptus tree detritus, the search for the yeast has increased. During the last three years, samples of detritus of common trees, mostly of almonds trees, from the western part of Puerto Rico, have been collected and processed to determine the presence of *Cneo/gat*. The *C.neo/gat* identities were initially determined using Niger Seed Agar growth analysis, production of urease and nitrate reductase and the carbohydrate assimilation profile. Confirmation was performed by the *in silico* analysis of the small ribosomal subunit 18s of the isolates. A total of ten candidates were isolated from mango (*Manguifera indicant),* almond (T*erminalia cattapa),* and avocado (*Persea sp.*) trees. The canavanine glycine bromothymol blue medium suggests that all the isolates belong to *Cryptococcus gattii.* These results represent the first report of the yeasts in tree detritus in Puerto Rico.

[Life Sciences-12]

Madera, Bismarck, UPR-RIO PIEDRAS; Bismarck Madera Soto, UPR Rio Piedras,Biologia Ciencias Naturales; Alejandro Ortiz Acevedo, UPR Rio Piedras,Biologia Ciencias Naturales; Juan C .Galloza, UPR Rio Piedras,Biologia Ciencias Naturales, Ruth E. Quintana, UPR Rio Piedras,Biologia Ciencias Naturales; Hernan L. Martinez, University of California, Dominguez Hills/ Chemistry; Jose A. Lasalde-Dominicci, UPR Rio Piedras,Biologia Ciencias Naturales

Lateral Diffusion Of The Torpedo Californica Acetilcholine Receptor In Oocyte Membrane

The purpose of this study is to determine if the diffusion of the *Torpedo* acetylcholine receptor (AChR), in oocyte membranes, is influenced by its lipid-protein interface.

Hydrophobicity analysis of the lipid-protein interface of the *Torpedo* AChR demonstrates that this receptor is more polar than the muscle-type AChR. We *hypothesize* that hydrophobicity of the lipid-protein interface is important for adaptation of the AChR to various lipid environments and that the diffusion of this receptor in a cell membrane is influenced by protein-lipid interactions.

The cDNA coding for all of AChR's subunits was linearized and transcribed to generate mRNA. The mRNA was then injected into *Xenopus laevis* oocytes. Three to four days after injection, the oocytes were used for the experiments. We first verified functional expression by measuring acetylcholine-induced currents using two electrode voltage clamp. The oocytes were then incubated with fluorescent α-bungarotoxin, Alexa-488 α-btx, to label the AChRs in the membrane. The labeled receptors were visualized using confocal microscopy. We employed Fluorescence Recovery After Photobleaching (FRAP) to estimate the fluorescence recovery time constant (*K*), the percent fluorescence recovery and the time estimated to reach half maximal recovery of fluorescence (half life; $t_{1/2}$) of the wild type (WT) *Torpedo* AChR. We also determined these kinetic parameters for the *Torpedo* AChR containing all of following lipid-exposed mutations: αS287A, αC412G, βY441W, γM299V, γS460I, δM293L, δS297V and δN305I (LEM *Torpedo* AChR). These mutations result in a *Torpedo* AChR with electrophysiological behavior similar to that of mouse WT (muscle type) AChR. We used the aforementioned kinetic parameters to calculate the diffusion constant using an equation based on that proposed by Axelrod, 1976:

$$D = \gamma W^2/4t_{1/2}$$

where *w* is the radius of the bleached region and γ is 0.88, a constant derived by the author to correct for the use of a circular laser beam. Our preliminary calculations for *D* for *Torpedo* WT and the LEM *Torpedo* WT are 0.0045 and 0.0035 μm^2/sec. These preliminary values suggest a slight difference in diffusion constants for these two AChRs.

Finally, we assessed if the diffusion phenomenon observed in our experiments was influenced by other types of diffusion, e.g. subdiffusion (Saxton, 2001). This kind of diffusion can occur as a result of molecular or cytoplasmic overcrowding (Weiss et al., 2004; Banks and Fradin, 2005). It has been determined that when subdiffusion occurs, the slope of the initial fluorescence recovery has values different from 0.5 (Saxton, 2001), when plotted as log recovery as a function of log time. The slope calculated from our data is 0.49, thus consistent with the notion that the diffusion for the AChR is normal diffusion.

This work was supported by NIH grants RO1GM56371-09, NCRR 1S0RR13705 and S06-GM08102-27 to JAL-D. We would like to thank the MARC program for their support to R. E. Quintana.

[Life Sciences-13]

Malavé, Josué, UPR-MAYAGUEZ; Rodriguez, Juan, Industrial Biotechnology, UPR-Mayaguez

A Bioluminescent Bacterial Survey from Marine Ecosystems of Puerto Rico

Bioluminescence is the phenomenon by which living organisms emit light though an organic oxidation. These luminescent organisms have been discovered in all kinds of ecosystems. Among their diversity, bacteria are the most widespread and abundant luminous organism in nature supporting a unique and necessary ecological role. Being Puerto Rico a tropical island, we intent to fully characterize this microbial group with classic and modern techniques to further comprehend their exceptional function in nature. Different approaches are being used to distinguish and identify between 81 isolates with variety of light emission intensities from the south coast to the northwestern side of Puerto Rico. Among the methods used are Gram stain and morphology confirmation though Scanning Electron Microscopy (SEM). In addition biochemical assays were performed to test their potential enzymatic capability to metabolize different energy sources such as nitrate, citrate, d-mannitol and lactose. Motility was determine by the SIM test and visualized successfully through Confocal microscopy. Genus and specie identification is been established for a number of isolates with molecular tools like Polymerase Chain Reaction (PCR), Restriction Fragment Length Polymorphism and *in silico* analysis. These isolates belong to different bacteria species like *Photobacterium leognathi*, *Vibrio harveyi* among others. Our long term research goal is to develop powerful biosensors to specifically detect contaminants through a measurable signal production.

[Life Sciences-14]
Maldonado, Yaritza, UPR-MAYAGUEZ; Baqar R. Zaidi, Marine Sciences, UPR Mayaguez

Distribution of Polycyclic Aromatic Hydrocarbon Degrading Bacteria

Polycyclic Aromatic Hydrocarbons (PAH's) are considered of environmental concern by its teratogenic, carcinogenic and mutagenic properties. Its widespread distribution and persistence in the environment allow the study of its effects in the marine and human life. Evaluating the capacity to biodegrade petroleum derived products in sediment samples can determine the degradative potential of bacteria for the recuperation and quality of coastal ecosystems. The aim of the present study is determine the patterns in biodegradation of phenanthrene degrading bacteria in coastal sediments of Guánica Beach, Ponce Beach, Guayanilla Bay and Guayanilla Beach. Guánica Beach was used as control. Enumeration of phenanthrene-degrading bacteria from sediment samples by overlayer technique was determined. BIOLOG MT microplates system was used to compare the microbial substrate utilization pattern at different sampling sites. Higher number of phenanthrene degrader bacterial colonies in Ponce Beach and Guayanilla Bay, followed by Guánica and El Faro Guayanilla was observed. Higher numbers of phenanthrene degraders in Ponce Beach site may be related with the development of Port Las Américas project. Methods are being refined and the identification of the phenanthrene degrading bacteria is in progress.

[Life Sciences-15]
Medina, Pamela, UPR-RIO PIEDRAS; Heinz, Heather, Department of Biology, North Carolina State University, Raleigh, NC 27695, USA; Parmelee, John S., Department of Biology, Johnson County Community College, Overland Park, KS 66210, USA., Powell, Robert, Department of Biology, Avila University, Kansas City, MO 64145, USA

Population Densities and Structural Habitats of Anolis Lizards on St. Eustatius, Netherland Antilles

Anolis schwartzi and *Anolis bimaculatus* are St. Christopher Bank endemics. In June 2004, we examined populations of both species at six sites on The Quill, a dormant volcano on St. Eustatius, in order to: (1) estimate population densities, (2) study microhabitat utilization, and (3) evaluate the structural niche breadths of both species and niche overlaps between species. Estimated population densities were 729-6812/ha for *A. schwartzi* on the leeward (west-facing) slope and 3201/ha and 4368/ha on the windward slope. *Anolis bimaculatus* was very rare in our leeward study plots, but we calculated densities of 1042/ha and 1667/ha for extensively insolated plots on the windward slope. *Anolis schwartzi* effectively utilized all sample habitats, but preferred those with

shade and abundant rocks. On the leeward side, *A. schwartzi* was most abundant on rocks and litter. On the windward side, both species preferred trunks of trees in the absence of large rocks; however, *A. schwartzi* appeared to prefer rocks, when available. Perch heights for *A. schwartzi* and *A. bimaculatus* were greater at windward than at the leeward sites, and *A. bimaculatus* perched higher than *A. schwartzi*. Both species used smaller trunks, but *A. bimaculatus* used larger trees than *A. schwartzi*, with adult males of both species of both species showing a preference for tree trunks of large diameter. Most individuals in all size classes of both species were in full shade. Niche breadths were generally indicative of habitat generalists and niche overlaps were high for all size classes of both species across all study sites.

[Life Sciences-16]

Monmany, Ana Carolina, UPR-RIO PIEDRAS; Carla Restrepo, Biology Dept., UPR-Rio Piedras

Herbivore-Parasitoid Body Sizes In The Landscape

Habitat fragmentation influences interactions among organisms, with likely consequences for the structure and function of biotic assemblages. Departing from the traditional approach on species diversity and abundance patterns, we focus on body size of herbivores and parasitoids to explore the consequences of habitat fragmentation on the structure and function of species assemblages. Specifically we ask (1) how does habitat fragmentation affect herbivore and parasitoid body size? And (2) how does body size of herbivores and parasitoids influence parasitism patterns?

To answer these questions, we collected and reared Lepidoptera larvae and parasitoid adults from 11 forest fragments and two continuous forests in the Yungas-Chaco ecotone, NW Argentina. We measured forward wing length of 465 adult Lepidoptera belonging to 80 morphospecies, and body length of 125 parasitoids from 47 morphospecies. We found that body sizes varied in the order of 10 in both Lepidoptera and parasitoids. Body sizes were best characterized by multimodal distributions in which the modes suggested functional groups. Moreover, body size distributions varied in fragmented landscapes due to changes in population sizes and/or functional groups. Some of these groups were constant under different degrees of fragmentation, an indicative of functional robustness. There was a significant relationship between herbivore and parasitoid morphospecies body size and fragmentation modified patterns of parasitism related to herbivore body sizes. Our exploratory results suggest that the analysis of body size patterns in fragmented habitats may yield new information on the response of biotic assemblages to fragmentation. Analyzing changes in body size patterns due to fragmentation may help us understand the link between structure and function in species assemblages.

[Life Sciences-17]
Raimundi, Koralys, UPR-MAYAGUEZ; Ballantine, David L. PhD, Department of Marine Sciences, UPR-RUM

Metapeyssonnelia Corallepida Overgrowth Of Millepora Complanatain Shallow Water Coral Reef Habitats In Southwest Puerto Rico

The red alga *Metapeyssonnelia corallepida* Verlaque, Antonius & Ballesteros is an encrusting epizoic species that was described based on collections from Florida and Belize in the Western Atlantic. *Metapeyssonnelia corallepida* overgrows live tissue of the coral *Millepora complanata* Lamarck. According to published accounts, the alga begins growth at the base of the coral and spreads distally increasingly covering coral tissue. *Metapeyssonnelia* overgrowth results in coral tissue death beneath the alga. This project is directed to determine prevalence of occurrence of *Metapeyssonnelia* on live coral, percentage of colony tissue killed and determination rate of spreading on coral tissue. Spreading rates of *M. corallepida* over *M. complanata* was measured as algal advance per month. Based on preliminary study, the algal advance was 1.96 mm/mo and 1.73 mm/mo for two different colonies tagged on Mario Reef.

[Life Sciences-18]
Rodriguez, Nydia J., UPR-MAYAGUEZ; Baqar R. Zaidi, Marine Sciences, UPR Mayaguez

Analysis of Antibiotic Resistance Pattern of Enterococcus spp.

Enterococcus spp. has been isolated from different aquatic habitats and used as an indicator of horizontal transfer of antibiotic resistance. This microorganism may survive longer in marine environment by its capacity to tolerate high salt concentrations. Therefore, we compared the presence of antibiotic resistant in fecal *Enterococcus* spp. by using selective media in coastal water of Barceloneta, Guánica, Guayanilla and Mayagüez, Puerto Rico. With the exception of Guánica all sampling sites are near big industrial cities in Puerto Rico, while Barceloneta is also site of big pharmaceutical as well as dairy industry. We used streptomycin sulfate, chlortetracycline hydrochloride, and oxytetracycline and salinomycin antibiotics because they are widely used in humans and animals. We compared *Enterococcus* spp. resistance to each antibiotic at different concentrations as well as resistance to multiple antibiotics. In Guánica, Guayanilla Mayagüez coastal water only 10, 12 and 12% of *Enterococcus* spp. respectively were resistant to chlortetracycline at 10 µg/ml and less than 5% were resistant when concentration was increased to 50µg/ml. However, in Barceloneta coastal water 48% and 27% of *Enterococcus* spp. were resistant to chlortetracycline at 10 and 50 µg/ml respectively. Similar resistance pattern was observed when oxytetracycline and streptomycin were used.

Numbers of *Enterococcus* spp. resistance to all three antibiotics were also highest in Barceloneta coastal water and lowest in Guánica coastal water.

[Life Sciences-19]

Ruiz, Francheska, UPR-RIO PIEDRAS; Ocasio,María, Department of Biology, University of Puerto Rico; Pérez, Raúl, Department of Biology, University of Puerto Rico; Velázquez, Iris M., Department of Biology, University of Puerto Rico

*Time Budgets In Prolonged-Captivity Plain Pigeons (Paloma Sabanera, Patagioenas Inornata Wetmorei)**

For two decades, the captive breeding program for the Puerto Rican Plain Pigeon was located at the University of Puerto Rico, Humacao. This very successful breeding program made great contributions to the conservation of this species. Although the program is now inactive, a few plain pigeons remain in captivity. The age of these individuals is over 20 years old, and they are not released because it is very unlikely that they may survive in the field. Given the amount of time that the individuals have been captive, we predict that the daily activities of these pigeons has been affected. In order to examine this hypothesis we video-recorded the behaviors at different times during the day. The two most common activities were resting and preening their feathers. Time spent resting and preening did not differ with time of day. Time spent at different locations of the cage showed that pigeons spent equal time among the lower perch, upper perch, and cage floor. Time of day did not affect time spent at different cage locations. Little time spent feeding or drinking during the day could be related to the fact that these cages had little environmental enrichment and they possess no special feeders that stimulate feeding through the day. However, mayor changes to the cages of these pigeons are not recommended because any changes in their environment may result in stress.

[Life Sciences-20]

Torres, Hernán, UPR-MAYAGUEZ; Schizas, Nikolaus, Dept of Marine Sciences, UPR-Mayaguez; Rhyne, Andrew L., Dept of Biology, University of Florida

Distinct Mitochondrial Lineages In Two Marine Caribbean Species With Different Dispersal Potential

Using direct sequencing of mitochondrial DNA genes (COI, 16S), we characterized the genetic population structure of two conspicuous macrofaunal species with Caribbean-wide distribution. We compared two benthic species: the low vagility chiton *Acanthopleura granulata* and the green emerald crab *Mithraculus sculptus* which has higher dispersion potential. Both species were sampled from the eastern Caribbean region (Bahamas, Dominican Republic, Florida and Puerto Rico). Analysis of Molecular Variance suggested that most of the genetic variation is observed within populations rather than among

populations for both species and for both genes. Phylogenetic analysis with both genes uncovered two distinct lineages distributing throughout the sampled region for each species. Consistent with previous studies, the analyses of mtDNA variation of these species suggest no significant population subdivision and wide gene flow in the sampled area of the Caribbean.

[Life Sciences-21]
Vega, Juan, UPR-MAYAGUEZ; Ríos-Velázquez Carlos, UPR-Mayaguez

Anoxyphototroph Purple Non-Sulfur Bacteria Isolated from Bromeliad Phytotelmata of Different Forest of Puerto Rico

Bromeliads are plants that form a structure with their leaves that allow the collection of rain water developing a microhabitat called phytotelmata. These natural bio-containers have a rich fauna that may play an important role in nutrient recycling systems in tropical forests. This study represents the first report of anoxyphototroph purple non-sulfur bacteria in tanks of bromeliad found in different forests of Puerto Rico. *Guzmania sp*. and *Tillandsia sp*. where the genera of bromeliad sampled in five different locations including, rain, dry and moist subtropical forests. Phytotelmata's stored water was enriched for purple non-sulfur bacteria and incubated in anoxic conditions in the presence of light. After the "bloom" of the purple non-sulfur the samples were streaked and isolated on plates in the same anoxyphototroph conditions. The reddish pigmented isolates were characterized microbiologically, by absorption spectra, scanning electron microscopy and physiologically using different nutritional sources. To date, a total of twenty six gram-negative rods shaped purple non-sulfur anoxyphototroph have been isolated. Whole cell absorption spectra confirmed the presence of bacterial photosynthetic pigments. Genomic DNA has been extracted from the isolates in order to complete the molecular analysis which included the PCR amplification of *pufM* and *16S rDNA* genes. The data obtained in the *in silico* analysis indicate that various species of *Rhodopseudomonas* and *Rhodomicrobium* genus may be part of the phyliosphere microflora of this habitat.

Mathematics

[Mathematics-01]
Hernandez, Mariely, UPR-RIO PIEDRAS

Exact and Approximate Posterior Moments for a Normal Location Parameter

The normal location parameter are of the form of the firts and second posterior moments. The exact and approximate are given by the prior distribution of the double exponential or the Student *t*. The explicit analytical form of the posterior density and the posterior moment are parameters derived for a normal conjugate. In general, if an arbitrary location family is assumed with a normal prior for the location parameters, explicit form for the posterior mean and variance. This result will provide an insight into Bayesian analysis for normal location parameter.

[Mathematics-02]
Ñeco, Maria, UPR-RIO PIEDRAS; Figueroa, Raúl, Mathematics Department, UPR-Río Piedras

An introduction to p-adic numbers

This is a basic introduction to p-adic numbers. We will introduce the p-adics algebraically and analytically as the completion of the rationals with respect to the p-adic absolute value. We will discuss the solution of the equation $x^2 = a$ in the p-adic field.

[Mathematics-03]
Pinero, Fernando, UPR-RIO PIEDRAS

Coding Theory applied to real problems

This poster will introduce some basics concepts of coding theory and will show some applications of it to varied real life problems. Examples include Bioinformatics, Space Probes, Music reproduction and others.

[Mathematics-04]
Torres, Hector, UPR-RIO PIEDRAS; Figueroa, Raúl, Mathematics, UPR-Rio Piedras

Test de Kummer

The Kummer Criterion is a criterion that is used to determine the convergence of a series of positive terms, of which derives from other criterions. The focus of the investigation was on the difficulty and appreciation of the application of the Kummer Test on series of the form $\sum_{n=1}^{\infty}\frac{1}{n^p}$ and $\sum_{n=1}^{\infty}a_n x^n$.

Physics

[Physics-01]
Betancourt, Jesuan, UPR-RIO PIEDRAS; Fonseca, Luis F, Physics, UPR-Rio Piedras; Resto, Oscar, Physics, UPR-Rio Piedras

Growth and Optical Properties of Silicon Nanocrystals Grown in Silicon Nitride Films

Our project intends to grow and study the optical properties of silicon nanocrystals grown in sputtered silicon nitride films. In the past years researchers in the hope of integrating the current silicon technology with Si based optoelectronic devices has tried to solve by different methods the physical inability of Si to act as a light emitter, one of these has been to grow silicon nanocrystals embedded in a silicon dioxide matrix. However, the luminescence of the Si nanocrystals embedded in a silicon dioxide matrix cannot be tunned to wavelengths shorter than ~550nm. Recently, in search of a better and more appropriate matrix for the nanocrystals, it has been demonstrated that a silicon nitride matrix grown by plasma enhanced chemical vapor deposition can provide efficient luminescence for a wider range of wavelengths.

Our research goal is to use sputtering technique to obtain silicon nanoparticles embedded in silicon nitride films with highly efficient and stable photoluminescence at wavelengths shorter than 550nm. This is of interest because of the industrial advantages of sputtering over CVD technique. We will present our recent results for Si nanocrystals synthesized by reactive sputtering of Si targets in a partial pressure of nitrogen.

[Physics-02]

Biaggi, Azlin, UPR-RIO PIEDRAS; Fonseca, Luis F., Physics Department, University of Puerto Rico-Rio Piedras; Resto, Oscar, Physics Department, University of Puerto Rico-Rio Piedras

Tuning the Cathodoluminescence of Porous Silicon Films

We have obtained intense cathodoluminescence (CL) emission from electron beam modified Porous Silicon films by excitation with electrons with kinetic energies below 2KeV. Two types of CL emissions were observed, a stable one and a non-stable one. The first type is characterized by a spectral peak that is red shifted with respect to the photoluminescence (PL) peak. The physically interesting and technologically promising CL is however the CL that correlates closely with the PL. Tuning of this CL emission was achieved by controlling the average size of the nanostructure thus showing that the origin of this CL emission is associated with the quantum confinement and the surface chemistry effects that are known to exist in the porous silicon system. We also found that the electron bombardment causes microscale morphological modifications of the films, but the nanoscale features appear to be unchanged. The structural changes are manifested by the increase in the density of the nanoparticles and this explains the significant enhancement of the PL that follows the electron irradiation.

[Physics-03]

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Vapor-Liquid-Solid Synthesis and Characterization of Sb2Se3 Nanowires

The Vapor-liquid-Solid (VLS) growth method was first developed in the 1960's but recently there has been a renewed interest in this method for growing nanowires of varying compositions. A VLS process was employed for the synthesis of Sb_2Se_3 semiconductor nanowires. The results show that Sb_2Se_3 nanowires have diameters in the range of ~ 10–80 nm. The as-prepared samples were characterized by scanning electron microscope, high-resolution transmission electron microscopy, electron diffraction, EELS, EDAX and micro-Raman Spectroscopy.

[Physics-04]
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Role Of Molybdenum Carbide Interface In The Field Emission Properties Of Nanocomposite Carbon Films

It is known that the presence of molybdenum carbide at the interface between carbon materials and the molybdenum substrates on which they are grown is crucial for the films to exhibit good field emission properties. In this study we investigate the role that molybdenum carbide plays on the field emission properties of nanocomposite carbon films grown by hot filament chemical vapor deposition. Growing conditions were adjusted to obtain films with different field emission yields. X-ray diffraction data show that the films' field emission properties are related to the peak intensities of the 002 orientation of Mo_2C [I(Mo_2C)] relative to the Mo substrate's preferential orientation peak intensities [I(Mo)], and that the field emission attains maximum values for I(Mo_2C)/I(Mo) ratios in the medium range among those of the studied films. The implications of these results on the understanding of the mechanism that governs field emission from nanocomposite carbon films are discussed.

[Physics-05]
Jauregui, Segundo, UPR-MAYAGUEZ; Perales-Peres, Oscar, Tomar, Maharaj; Parra, Adrian

Low Temperature Sol-Gel Synthesis Of Eu-Doped Zno Nanocrystalline Powders

The synthesis of nanocrystalline powders of bare and Eu-doped ZnO by a modified Sol-Gel method is reported. ZnO based nano-powders were synthesized from precursor Zn and Eu(III) acetate salts. Highly crystalline oxide structures were produced directly from starting solutions with no need for any thermal treatment. The establishment of the ZnO structure was verified by Infrared (FT-IR) spectroscopy, while the crystalline structure and average crystallite size of synthesized powders were determined by X-ray diffraction (XRD). The results evidenced the wurtzite structure with no significant change in the lattice parameters as could be expected for Eu^{3+} incorporation. Photoluminescence (PL) spectroscopy measurements at room temperature evidenced the presence of ZnO and Eu^{3+} species in those powders synthesized at different dopant concentrations. A broad PL band, attributed to defects in ZnO structure, coexisting with sharp bands attributed to intra-4f shell interactions, was clearly identified. The substitutional or surface incorporation of Eu species in the ZnO structure will be discussed. Results from Raman spectroscopy and UV-Vis measurements will also be presented.

Keywords: ZnO, europium, nanocrystalline powders, sol-gel

[Physics-06]
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Influence of Filling of Polymer with Nanoparticles on Relaxation Processes and Glass Transition

We report the results of the investigations of the influence of filling of polymer with Aerosil nanosize particles on the glass transition and dynamics of the alpha- and the beta-relaxation processes in poly(butylmethacrylate) by dielectric spectroscopy and differential scanning calorimetry (DSC). The polymer was filled with hydrophilic and hydrophobic Aerosil particles of 12 nm diameter. Both the alpha- and the beta- relaxation processes were observed in filled polymer. However in filled polymers the characteristic frequency of the alpha-process was shifted to higher frequencies in comparison with pure bulk polymer. This suggests that the filling of the polymer with nanoparticles has resulted in the shift of its glass transition temperature T_g. This change in T_g was mainly due to the existence of a developed pore wall/solid particle-polymer interface and the difference in the dynamic behavior of the polymer in the surface layers compared to that in the bulk. This result was in agreement with DSC experiments. Variations of size of filling particles and their concentration are helpful in understanding of relaxation properties at polymer – solid interface as well as of a role of surface interactions in glass transition.

[Physics-07]
Majumder, Sarmistha, UPR-RIO PIEDRAS; Aliev, Fouad, Physics Dept, UPR Rio Piedras

Molecular And Collective Dynamics In Nanoconfined Liquid Crystals

The results of broadband dielectric spectroscopy (frequency domain, the frequency range: 0.1 mHz - 1.5 GHz) and photon correlation spectroscopy (time domain, the dynamic range: 15 ns - 1000 s) and ultra investigations of the influence of confinement on the dynamic behavior of liquid crystals (LC) dispersed in porous matrices with randomly oriented, interconnected pores and parallel cylindrical pores will be presented.

The combination of these methods allows obtaining detailed information on dynamics molecular modes as well different collective excitations.

The confinement strongly influences the dynamical behavior of liquid crystals and is resulted in qualitative changes in their properties. We observed deep supercooling of 5CB in pores up to 160 degrees below the bulk crystallization temperature. The relaxation time of the process due to the molecular rotation in deeply supercooled state is slower than at the temperatures corresponding to nematic phase by a factor of 10^6. This slowing down is accompanied by anomalous broadening of the dielectric spectra. The widths at half maximum of the dielectric spectra and the relaxation time distribution functions of deeply

supercooled 5CB are 5 times wider than in nematic phase. Other new properties observed in confined 5CB are two low frequency relaxation processes absent in bulk 5CB. One of these processes is due to the molecular relaxation in the surface layers at liquid crystal-solid pore wall interface. The second process is probably a collective mode due to the relaxation of the surface induced polarization. The collective process due to surface polarization and the surface molecular mode show features typical for glass formers.

The photon correlation spectroscopy experiments also show significant changes in the physical properties of confined LCs and suggest that there is some evidence for glass-like dynamical behavior, although bulk liquid crystals do not have glassy properties. The slow relaxation process which does not exist in bulk LC and a broad spectrum of relaxation times appear for LC confined in random and in cylindrical pores. Since both the slow relaxation process which does not exist in the bulk LC and the broad spectrum of relaxation times appear not only for LC in random pores but in cylindrical pores, we suggest that the differences in the dynamical behavior of confined LC from that in the bulk are mainly due to the existence of the LC-pore wall interface.

[Physics-08]

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Nanostructured boron nitride films by chemical vapor deposition with catalyst Fe2O3 and NiO

Boron nitride nanofibers are promising materials in various applications such as microelectronics and strong and light-weight composite materials. Compared to other methods, the hot-filament chemical vapor deposition (HFCVD) technique offers some unique advantages in terms of scalability for the selective deposition of BN nanofibers over large area substrates. Boron nitride nanostructures, including nanofibers, were synthesized on silicon substrates and with catalyst by HFCVD using borazine diluted in hydrogen as precursor. The effects of substrate temperature on the nanostructures produced were studied within the range 500-900 ^{o}C. The nanostructures were characterized by high-resolution transmission microscopy, electron energy loss spectroscopy, energy dispersive spectroscopy, scanning electron microscopy, and X-Ray diffraction. Differential thermal gravimetric analysis operated in air and inert atmosphere was employed to determine the resilience of boron nitride nanostructures to sublimation at high temperatures. The results indicate that the HFCVD technique is suited to synthesize high-quality BN nanofibers at high yield.

[Physics-09]

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Dielectric spectroscopy of pulsed laser deposited type PbZr0.53Ti0.47O3-CoFe2O4 (PZT-CFO) composite thin films

Magnetoelectric materials, which exhibit simultaneous magnetic and ferroelectric ordering and with coupling between the two properties, are now a days being studied extensively for a variety of device applications. As compared to single-phase materials the magnetoelectric effect is reported to be more pronounced in piezoelectric-ferromagnetic bulk composite and thin films. In case of thin film composites it has been experimentally observed as well as theoretically predicted that ferromagnetic columns, epitaxially grown in piezo/ferroelectric matrix (1-3 composites) exhibit large magnetic induced electric polarization responses (MIEP). Compared to the 1-3 composites the MIEP response in lamellar (2-2 type) type composite is predicted to be significally low. The weak magnetic effect is reported to be due to clamping effect of the substrate that inhibits the in plane piezo-deformation in such structures. From the studies it appears that the distribution of ferromagnetic phase in piezoelectric matrix plays an important role obtain high magnetoelectric coefficient. In the presents work we prepared 2-2 type composites thin films by pulsed laser deposition. Upon rapid thermal annealing, as envisaged from cross sectional SEM as well as XPS depth profile analyses, the layered structures are no longer maintained and PZT-CFO are phase separated to yield 0-3 type composite thin films. For alternate deposited $PbZr_{0.53}Ti_{0.47}O_3$-$CoFe_2O_4$ (PZT-CFO) multilayered film (350 nm thick, 3 PZT layer 90 nm each, and 2 CFO layer 40 nm each), rapid thermal annealing at 650 ℃ for 150 s, dielectric constant, remanent polarization, and remanent magnetization at room temperature were measured to be 560 (at 100 KHz), 18 $\mu C/cm^2$ (at 12V), and 26 emu/cm^3 (55 KOe) respectively. These films also exhibit a temperature independent dielectric constant over a wide temperature range. Impedance spectroscopy analyses were performed to electrically model, the system as insulating PZT matrix and semiconducting CFO regions with different relaxation times. The observed dielectric relaxation has been explained by Maxwell-Wagner type contributions at the interface between insulating PZT and semi-insulating CFO regions

[Physics-10]

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Effect Of Reaction Temperature On The Structural And Optical Properties Of Zno Nanocrystals

The quantum confinement effect and the strong size-dependence of the optical properties have been verified for different nanosize semiconductors. ZnO, having wide band gap of 3.29 eV and a direct band gap structure at room temperature is considered a very promising material for optoelectronic and spintronics applications. Systematic study is required to find out the effect of crystal size on the structural and optical properties of ZnO at the nanoscale level. The present research addressed the size-controlled synthesis of ZnO nanocrystals at different temperatures. In order to study systematically the dependence of crystal size with synthesis conditions in ethanol, stable suspensions of these nanocrystals were produced at various temperatures, ranging from 0 ^{0}C to 60 ^{0}C. The XRD patterns of ZnO nanocrystals synthesized at different aging times and synthesis temperatures suggested well and fast formation of the oxide structure even without aging. Moreover, the XRD patterns show a significant shift in the peaks position, which is evidence of a progressive increment in their lattice parameters for the non-aged samples prepared at 0 ^{0}C and 60 ^{0}C, respectively. The FT-IR spectra of ZnO crystals synthesized at 0^{0}C show stretching vibrations of the Zn-O bonds and stretching vibration of C=O, C=C and C-H bonds, respectively that correspond to acetate species. The high monodispersity of the 5-8nm ZnO nanocrystals was revealed by HRTEM analyses of the samples synthesized at room temperature. Particle growth and aggregation would have been inhibited due to the acetate adsorption. UV-Vis and PL measurements evidenced the continuous growth of the nanocrystals by prolonging aging.

[Physics-11]

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Dielectric Relaxation In Thin Liquid Crystal Layers Formed On Cylindrical Pore Walls

Dielectric Spectroscopy was used to study the influence of layer thickness of confined liquid crystal (with different orientation of molecules at pore walls) on relaxations due to surface induced polarization and due to molecular reorientations. Low frequency measurements provided information on the relaxation of surface polarization that arose at the liquid crystal-pore wall interface. The dynamics of molecular reorientations were investigated in high

frequency experiments. The influence of molecular orientation on temperature dependence was also investigated.

[Physics-12]
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Luminescence Of Rare Earth Doped Si/Al/Sio$_2$ Co-Sputtered Films

Er^{3+}, and Nd^{3+} doped $Si/Al/SiO_2$ and thin films have been prepared by rf co-sputtering. Some of these films were annealed to 700ºC. Erbium doped $Si/Al/SiO_2$ films were prepared with two different sputtering configurations: one configuration with a large quantity of Al and a second configuration with a smaller quantity of Al. The configuration with large quantity of Al shows a diminished luminescence at 1.53 μm, but this emission is increased by substrate heating. The configuration with smaller quantity of Al shows emission at 1.525 μm similar in intensity to the Er-doped Si/SiO_2. The spectral shape for the $^4I_{13/2} \rightarrow {}^4I_{15/2}$ emission is broader than for an analogous Er^{3+} doped Si/SiO_2. The smaller quantity of Al configuration increases the solubility of Nd^{3+} (and luminescence for high Nd^{3+} concentration) in Si/SiO_2 films and changes the spectral shape of the $^4F_{3/2}$ emission with respect to the Nd^{3+} doped Si/SiO_2 films.

[Physics-13]
Sola, Francisco, UPR-RIO PIEDRAS; Resto, Oscar, Physics, UPR-Rio Piedras; Biaggi-Labiosa, Azlin, Physics, UPR-Rio Piedras; Fonseca, Luis, Physics, UPR-Rio Piedras, Sanchez, Germarie, Chemistry, UPR-Rio Piedras; Cabrera, Carlos, Chemistry, UPR-Rio Piedras

Synthesis of Silica Nanowires, Silica/Carbon and Carbon Nanostructures and Their Applications to DNA Sensing

One of the key parameters to the development of nanothecnology is the full control of the size and the shape of nanomaterials during their synthesis. A novel synthesis of silica nanowires and silica/carbon heterostructures by electron beam irradiation on porous silicon (PSi) films was investigated. The method allows us to monitor the growth process in real time at atomic scales. Depending on the electron dose we obtain nanowires with diameters in the range of 15-49 nm and lengths up to 481 nm. We found that the adequate electron dose was between 10^3–10^5 electrons/nm^{2}s. Additional electron dose causes plastic and failure deformations in the silica nanowires. We obtain a nanopalm-like structure and carbon nanotrees after exposing them to poor vacuum conditions. A growth model consistent with our findings is presented. We also present evidence of attachment of a sequence of ss-DNA to the carbon nanotrees.

[Physics-14]
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Optical Properties Of Nanocrystalline Diamond (NDC) Synthesized In DC Plasma Assisted Argon-Rich HFCVD

The unique structural, tribological and electronic properties of ultra nanocrystalline diamond (UNCD) make it one of the promising material for a number of applications. The scalability which is a distinctive advantage of hot filament chemical vapour deposition (HFCVD) over microwave CVD (MWCVD) makes it favourable industrial technique. The NCD films were grown by varying the argon gas concentration [$Ar/(Ar+H_2)$] from 80 to 95% and substrate temperature. The optical properties of the NCD films grown in argon rich gas atmosphere over wide parametric window were examined using spectroscopic ellipsometry in the energy range (1.46 -2.88 eV).

The ellipsometry data [Ψ,Δ] were modelled using Bruggeman effective medium (BEM) approximation and Forouhi and Bloomer dispersion relation. The dielectric function and optical band gap were estimated by simulating the data with by least square regression analysis. The films are further characterized with Raman spectroscopy, transmission electron microscopy and electron energy loss spectroscopy.
Keywords: UNCD, HFCVD, spectroscopic ellipsometry

[Physics-15]
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Photoluminescent Nanocrystalline Silicon Nanoprobes for cellular imaging

We will report on the preparation of nanocrystalline silicon suspensions and their use for the imaging of dynamic cellular processes. The silicon nanoparticles are synthesized by a top-down technique in which silicon wafers are electrochemically etched with a water:HF:Ethanol solution and by following the protocols applicable to the synthesis of Porous Silicon. The prepared nanoporous structures are then sonicated to obtain silicon nanoclusters in ethanoic solution. The nanoclusters are then implanted in the living tissue by using the gene gun delivery technique and the stability of the photoluminescence of the nanoclusters is analyzed. Preliminary tests of the applicability of the silicon nanoclusters as photoluminescent bionanomarkers will be presented.