

## The Waiting Game... U.S. Economics!

Dr. Castaño's Group Report:

Another year already?! Jinx! Time is going faster as I age. Last year I was celebrating the news about grants entering my group. This year, we are reaping the first fruits of having money to hire students and do research. Four papers have been submitted to peer-reviewed journals and by the end of the summer four more should be submitted. The papers are on multiple areas including: chemically bonded phosphate ceramics for nuclear radiation containers (J. Nucl. Mat), production of palladium nanoparticles on carbon nanotubes produced by gamma irradiation (Rad. Phys. Chem), simulations of a micro x-ray source design, benchmarking efforts of the MSTR MCNP model (Nucl. Eng. Des.), the creation of an internet accessible hot cell now available at MSTR (Nucl. Eng. Des). Also, there was an invited contribution on nuclear fuel reprocessing to the Wiley Nuclear Energy Encyclopedia that will be published later this year.



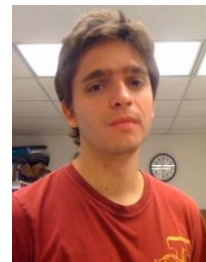
Adapted from the Secret of the Golden Flower

These research lines together with our ongoing research and development initiatives in the nuclear engineering program including a new neutron generator facility, and active cooling design and installation for MSTR, is keeping us (my research group and also my colleagues) busy and happy in the Department. Good things are happening; we are increasing the capabilities of the program and looking towards the future.

Unfortunately, the heavily politicized debate on budget appropriations in the US this year and the settlement on deep cuts is likely to negatively influence our initiatives this year and probably in the future as well. Two grants, one on the study on fatigue of highly irradiation resistant materials (oxide dispersion strengthen steels – ODS), and a continuation proposal on the creation of a radiochemistry laboratory in our program have been both frozen for months waiting for a decision at the funding agencies, which cannot decide since there is not word of how the new cuts will be applied.

I want to present my research group, by letting my students briefly describe themselves and what they do. Without their work, there would be no research group and frankly very little would happen at all. It is their sustained work that allows research to happen at Missouri S&T, and whatever success we achieve is thanks to their efforts.

**Chrystian Posada:** I just obtained my MS degree and currently I am in the process of obtaining my PhD degree. For my MS. Thesis I used a Particle in Cell (PIC) simulation and performed the conceptual design of a field emission based electron source. This electron source is to be used on the generation of x-rays from a flat panel in collaboration with researchers of Argonne National Laboratory. The results from this research have been published at the Medical Imaging 2011 conference of the SPIE and were also showcased at the 2010 Memphis Bioluminescence Symposium. Results were also submitted for publication in the Journal of Vacuum Science and Technology. I have participated on two occasions in the Advanced Test Reactor National Scientific User Facility, in 2009 and 2010. It



have been about three years since my first day in Rolla, and the more time I spend here, the more I realize how great this opportunity is for my personal and professional life. My plan is to work as hard as necessary to accomplish the goals and enjoy as much as possible the experience of being part of the Missouri S&T community.

**Jessika Rojas:** One of the motivations in our research group has been hydrogen as an alternative source of energy (a project funded by the U of Missouri Research Board). We have observed the evolution of nanostructures using chemical as well as radiation techniques. This project has also been for me a big gate to learn about different characterization techniques, so I received training in SEM, FIB, Raman spectroscopy and FTIR. Those techniques were used as a tool to analyze the changes in the structure. Our next step on this project is to evaluate the mechanism of functionalization by gamma rays based on the creation of reducing agents from water radiolysis. Aqueous solutions containing carbon nanotubes, palladium chloride and a secondary alcohol will be irradiated with a gamma source of  $^{60}\text{Co}$  in the University of Illinois and at our Nuclear Reactor (MSTR).



**Brad Richardson:** Brad is very close to completing his MS degree. His benchmarking of the MCNP simulation model of MSTR has been very interesting and has produced two papers currently in the submission process to the peer-review literature. This work will be continued and we expect can eventually be used to increase the power rating of MSTR.



**Jason Pleitt:** I'm a new graduate student from Warrenville, IL. I recently graduated from the nuclear program here at MS&T this past spring before entering the graduate program. I had met Dr. Castano as his first undergraduate advisee back in 2008. I am currently working on measuring linear attenuation coefficients at different energies for a special ceramic/cement for shielding purposes. I've developed the basic design for the measurement and am working on making sure that the values can be accurately determined at several energies. I look forward to working more on this project in the coming year including neutron attenuation measurements.



**Vivek Rao:** I received my Bachelor's degree in Chemical Engineering from Vishveswaraya Technological University, Bangalore, India in 2010 and I joined Dr. Castano in early 2011 to work on hydrogen storage in carbon nanotubes decorated with metallic nanoparticles, in which my colleague Jessika has made commendable progress. We are also collaborating with Dr. Tsai (Mechanical Engineering) who is a pioneer in laser manufacturing processes. Our goal is to synthesize metallic nanoparticles on carbon nanotubes by laser ablation of metal salts. An evaluation of deposition schemes between gamma irradiation and laser ablation is a vital focus of our research. An auxiliary project is to evaluate the synthesis of metallic nanoparticles to produce nano-fluids. Nano-fluids are of interest because they have massive heat and mass transfer properties due to their enormous specific area/volume characteristics, which have applications in nuclear and chemical engineering industries.



**Blake Bohn:** I'm from Jackson Missouri, I transferred in from a small college to S&T for nuclear engineering. Normally I spend most of my time in Rolla doing homework or research. It can get very busy but I like learning about nuclear technology so it's very enjoyable. In my free time I like to shoot firearms, go caving, float down rivers, hiking, and collecting common radioactive



materials/isotopes. My first nuclear class at Missouri S&T was NE105. That's where I meet Dr. Castano. He was looking for research assistants for a radiochemistry initiative. I did not have much experience and knew I needed to learn more so I volunteered. I found out later that I would be helping set up a radiochemistry and nuclear forensics lab. I found out that we would need an alpha spectrometer. Dr. Usman's lab had an alpha spectrometer and I spent most of my time calibrating and setting up the equipment.

**Rob Zedric:** I'm a junior from Decatur, IL. Apart from classes, I keep myself busy on the Rolla Rural Fire Department, where I'm a firefighter and an EMT. In my free time, I enjoy shooting guns, snowboarding, and building electronics. Though I came to Rolla for mining, I switched to nuclear engineering when I realized I didn't like rocks. I wanted something more energetic and challenging, and I hoped to find it in this rare field. Soon after I met Dr. Castano in his Intro to Nuclear class, he told me he was founding a nuclear laboratory on campus and wanted student workers to help. I thought it would be a great opportunity to get involved in research, so I signed up. Right away, he gave me experiments to work on and a laboratory to work in. I am currently evaluating a technique to measure radium concentrations in ground water, but will soon move on to designing a nuclear bar code to tag explosives (nuclear forensics).



**Alberto Gomez:** I'm a junior from Lenexa, Kansas, and I'm studying Nuclear Engineering at MST. I met Dr. Castano in NE 105, where he was looking for undergraduates to assist in research. I was interested in learning more and gaining experience, so I inquired about the position. I found out that I would be learning about the electrochemical side of Nuclear Engineering, studying such things as the corrosion of parts in a nuclear power plant. I have recently ordered samples of metals typically used in power plants and will soon be testing the effects of corrosion on these metals. In my free time I enjoy playing guitar, seeing live music, playing video games, and watching TV shows and movies.



**Adam Stensland:** I am a Junior in the Nuclear Engineering department from Edwardsville, IL. Dr. Castano is my advisor, which allowed me to inquire about research positions. I have been helping out with the Oxide Dispersion Strengthened (ODS) Steel project. ODS are alloys that have nanoparticles incorporated in their structure, giving them particularly resilience to radiation damage. While we wait for a decision from the funding bodies, I have been keeping busy by doing bibliography research and learning how to use the finite element simulation program Abaqus to study deformation and fatigue of specially shaped specimens (Krouse).



**Andrew Mills:** I'm a Junior at S&T. I'm eager to learn about all parts of the Nuclear Engineering field, which led me to Dr. Castano. When he offered in NE-105 a chance to do some undergrad research in the electrochemical field of Nuclear Engineering I couldn't say no, as this would be a great opportunity to expand my knowledge. If I'm not in the lab or doing homework I enjoy running, working out, ultimate Frisbee, playing video games with friends, napping, and anything else to refresh my mind from the trials and tribulations of a Missouri S&T undergrad.

