Symposium on Undergraduate Nano-Education:
"Addressing the Challenges of Nanoscale Science & Engineering Education"

Presentation:

Application-Centered Nanotechnology Experiments for First-Year Students

Kurt Winkelmann, Christina Termini, Angela Camp
Department of Chemistry, Florida Institute of Technology, Melbourne, Florida, 32901

Presenter Biography:

Dr. Kurt Winkelmann is an Associate Professor of Chemistry at the Florida Institute of Technology. His primary research interest is developing interdisciplinary nanotechnology experiments for freshmen students. The purposes of these experiments are to introduce students to nanotechnology and also to maintain students' interest in science and engineering during the early stages of their college career. In 2003, Dr. Winkelmann and two other colleagues received an NSF NUE grant to develop one of the first interdisciplinary nanotechnology lab courses for first year students. This research has resulted in several publications, including a chapter in Nanoscale Science and Engineering Education that describes Florida Tech's introductory nanotechnology lab course.

Dr. Winkelmann's other active research projects include creating virtual lab experiments in Second Life, adding research-inspired experiment modules to improve the general chemistry laboratory curriculum, and semiconductor photocatalysis for the removal of air and water pollutants.

Besides co-teaching the introductory nanotech lab course, Dr. Winkelmann also teaching general chemistry and physical chemistry lectures and co-teaches a computer applications course for chemistry students. He also serves on the editorial board of the *Journal of Nano Education*. Each year, Dr. Winkelmann and a colleague host Camp NanoTech, a summer day camp for high school students interested in science, engineering, and especially nanotechnology.

Abstract:

Two new experiments are being developed for an introductory nanotechnology laboratory. (1) Nanocomposites are both lightweight and strong materials that are used in many structural applications. Students prepare polymethylmethacrylate containing aluminum oxide nanoparticles and measure the nanocomposite's flexural stress-strain properties. Results indicate that low concentrations of nanoparticles in the polymer provide the greatest mechanical improvement while higher concentrations are not as beneficial. Students learn why this occurs and are asked to consider the possible advantages and disadvantages of nanocomposites compared to the pure polymer or other structural materials. (2) Silver nanoparticles are known to be effective antibacterial agents and are used in a variety of commercial products. Students prepare silver nanoparticles using various chemical synthetic methods and add them to bacteria cultures. Optical absorbance measurements show which silver nanoparticles are most effective at preventing bacteria growth, based on the cloudiness of the solution. Students learn the various theories that attempt to explain the antibacterial effectiveness of silver nanoparticles.