

Research on Nanomaterials: From Fullerenes and Nanotubes to Nanoparticles

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The research program in Prof. Sun's group is centered on the development of nanostructures and nanomaterials for novel optical properties, electrical and thermal conductivities, and fluorescence labeling and imaging applications. Current projects in the area of fullerene and nanotubes include the synthesis and study of fullerene derivatives, and the covalent functionalization of carbon nanotubes. Our projects in the area of nanoparticles are related to the production of metal and semiconductor nanoparticles using supercritical fluid technology and the use of the nanoparticles thus produced as precursors in the fabrication of nanocomposite materials. We are also establishing a program on the development of a new class of quantum dots based on carbon. Specifically, the REU students are expected to join graduate students and postdoctoral fellows to participate in these ongoing research projects. They will have choices among the following selected activities that are more suitable for undergraduate students in a 10-week period. (1) To participate in the production and purification of fullerenes, carbon nanotubes, and carbon nanoparticles. (2) To participate in the synthesis of organic and polymeric precursors and in the functionalization of fullerenes and carbon nanotubes with the selected organic and polymeric species, including also natural proteins and other biomolecules and species. (3) To participate in the production of nanoscale particles with the use of supercritical fluid processing techniques, especially the Rapid Expansion of a Supercritical Solution into a Liquid SOLvent (RESOLV) technique developed in our laboratory, and also to participate in the characterization of these nanoparticles by using a variety of instrumental methods such as electron microscopy and X-ray diffraction. (4) To participate in the fabrication of polymeric nanocomposite materials, especially thin films, that are based on the nanoparticles and nanotubes developed in our laboratory. These activities are all highly interdisciplinary in nature, which thus provide the best opportunities to the training of REU students.