

NANOMATERIALS: SYNTHESIS, CHARACTERIZATION AND APPLICATIONS

EMCH 792K

This is a graduate level course for those interested in the science and technology of a new class of materials that has been creating a technological revolution in the last decade. The common ground for these materials, and the devices made from them, is that they are constituted of building blocks of metals, ceramics or polymers that are nanometer size (1-100 nm) objects. The properties of such materials are novel and can be engineered by controlling the dimensions of these building blocks and their assembly via physical, chemical or biological methods. The focus here will be nanomaterials synthesis, characterization and applications. The basic physics and fundamental mechanisms responsible for nanoscale-induced changes in properties will be stressed. Representative advances in each of the targeted topical areas will be discussed and examined to provide students with some insight with regard to the potential future impact of nanotechnology on materials science and engineering. A term paper is also included to provide students with an opportunity to explore in-depth, a nanotechnology topic of their choice.

Prerequisite:

None

Topics:

Advances in nanomaterials; impact of present day research and development; synthesis of nanomaterials; nanoparticles, nanotubes/wires, nanometer thick thin films, nanostructured bulk materials; assembly of nanostructures; biological structures; structure-property-correlations in nanomaterials and nanostructures; advanced characterization techniques; applications especially those related to nanotechnology, information technology, MEMS/NEMS, and biotechnology.

Class Format:

Seminar-type course consisting of lectures, laboratory demonstrations, discussions, reading assignments on research topics, student presentation on selected topics from above areas.

Projects:

A term paper is required. It will represent 50% of a student's final grade. The goal is to select a journal paper or set of papers that describe a recent advance in nanomaterials as outlined in the context of this course. The selected topic accompanied by a one page outline must be submitted to the instructor prior to final approval to proceed. This paper serves both a mechanism to acquaint students with the recent literature in nanomaterials, as well as an opportunity to improve their written communication skills.

Texts:

1. Nanomaterials: Synthesis, Properties and Applications, ed. By A. S. Edelstein and R. C. Cammarata, Institute of Physics, UK, 1966
2. Nanostructured Materials: Processing, Properties and Applications, ed. By C. C. Koch, William Andrew Publishing, New York, 2002