

**MATERIALS SCIENCE AND ENGINEERING
SEMINAR**

**Synthesis and Characterization of Nanoparticles for Biosensor
Applications**

by

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ABSTRACT

Biosensors have been developed for detection, quantification, and monitoring of specific biomolecules or chemical species for environmental, clinical, and industrial fields. Nanoparticles, which can be functionalized by various materials, have attracted research interest in the electrochemical biosensors field due to their versatile physical and chemical properties. Thus, nanoparticles and nanocomposites have been widely investigated as a matrix for the electrochemical biosensors of the detection of various molecules.

In this work, nanoparticles, including Fe₃O₄/silica core/shell nanocomposites, CaCO₃-CdSe/ZnS/silica composites, Au nanocrystals, and Cu₂O & Cu₂O/Au particles, were synthesized and applied for the design of electrochemical biosensors. The goal of this research is to investigate novel nanoparticle-based platforms for the design of highly sensitive and stable biosensors. Biosensors can be categorized into enzyme-based biosensors and enzyme-free biosensors depending on whether or not enzymes are present in the system. Fe₃O₄/silica core/shell nanocomposites and CaCO₃-CdSe/ZnS/silica composites were used as material platforms to immobilize enzymes and fabricate enzyme-based electrochemical biosensors. On the other hand, Au nanocrystals, Cu₂O, and Cu₂O/Au particles, which display significant catalytic and electron transfer properties, were investigated in enzyme-free biosensor configurations. In addition, the morphology-dependent biosensing properties of Au nanocrystals, Cu₂O, and Cu₂O/Au particles were investigated.

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