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**Effect of biocatalytic reactions on growth of semiconductor nanoparticles: Application to biosensing**

Our laboratory discovered for the first time that products of enzymatic reactions are able to modulate growth of semiconductor fluorescent CdS nanoparticles (NPs) grown in situ. Emission spectra of these NPs depend on their size and capping agents which stabilize them in aqueous solutions. We found out experimental conditions under which the growth of CdS NPs is very rapid and takes 10 min or less. The biocatalytic growth of CdS NPs has been applied to optical determination of enzymatic activities of enzymes such as acetylcholine esterase,<sup>1</sup> horseradish peroxidase,<sup>2</sup> glucose oxidase<sup>3</sup> etc. We also reported novel sensitive selective electrochemical assays based on generation of CdS NPs in situ which is modulated by affinity interactions and oxidative activity of metal ions. For example, our immunoassay employs antibody-alkaline phosphatase conjugate which catalyzes generation of CdS detected with disposable carbon electrodes premodified with the electroconductive polymer Os-PVP.<sup>4</sup> We demonstrated a new electrochemical assay employing microbead linked enzymatic generation of CdS QDs (Microbead QD-ELISA)<sup>5</sup> for cancer marker superoxide dismutase. In the presence of this analyte, CdS NPs were formed on the surface of microbeads modified with antibodies for superoxide dismutase (Figure 1). Formed in situ CdS NPs were followed with fluorescence spectroscopy, microscopy, and square-wave voltammetry. Our latest assays use cysteine (CSH) which stabilizes CdS NPs growing during the biorecognition event in aqueous buffered solutions. Oxidation of CSH with hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) results in formation of cystine (CSSC) which does not stabilize CdS NPs. A number of chemical and biochemical reactions involving copper ions, glucose<sup>6</sup> and methanol yield hydrogen peroxide, modulating the quantity of CdS NPs produced in situ.



Figure 1. Microbead linked enzymatic generation of CdS nanoparticles.

**Biography**

V. Pavlov obtained his PhD degree in Chemical Engineering in January 2005 from the University Rovira I Virgili (Spain). He worked in the Hebrew University of Jerusalem (Israel) in the group of professor Itamar Willner as a postdoctoral researcher. Since October he continued his postdoctoral study at the Chemistry Department of the University of Heidelberg (Germany). In February 2007 he joined the new research institute CIC BiomaGUNE in San Sebastian as a group leader. His research interests include enzymatic generation of metal and semiconductor nanoparticles, production of new recombinant mutated enzymes, and optical bioanalytical assays.

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