

“Stochastic Photoelectrochemistry of Colloidal Semiconductor Nanoparticles”

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We present our results on the detection of colloidal nanoparticles (NPs) of semiconductors. Under continuous irradiation, TiO₂ NPs oxidize MeOH, a well-known hole scavenger. The NPs interact with our working electrodes in a characteristic manner. Under certain conditions, single NPs can be detected. We present TiO₂ as our main case of study due to its photoelectrochemical stability.

Depending on preparation conditions TiO₂ NPs can be charged during illumination by injection of electrons into the conduction band. The effect of this long-lived charge in the stochastic electrochemistry is discussed.

In the absence of appreciable charging effects, TiO₂ anatase NPs display a step-wise photoelectrochemical current. We assigned these steps to the particle-by-particle contribution of the individual NPs, as they interact with the microelectrode used in the detection (10 micrometers diameter). The current vs. time response is a function of the colloidal behavior of the NPs and of the electrode material. These effects will be presented along with our current understanding of the complicated colloidal behavior of the TiO₂ NPs

We also discuss the possibility of extending this experiment to different semiconducting NPs. We investigate the use of CdSe as a case of study of NPs of tunable band gap and size.