The Fascinating World of Nanocrystals, from Light-Emitting Diodes to Solar Cells

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Mesoporous oxide films are made up of a network of nanocrystalline oxide particles such as TiO2, ZnO and Nb2O5 which are interconnected to allow for electronic conduction to take place. The pores between the particles are filled with a semiconducting or a conducting medium, such as a p-type semiconductor, a polymer, a hole transmitter or an electrolyte, constituting a junction of extremely large contact area. In this way interpenetrating bicontinuous network are formed which are phase-separated by a heterojunction.

This keynote lecture will adress the unique optoelectronic and electrochemical features of such films. In particular, the factors that govern interfacial charge transfer reactions and lateral electron transfer along surface attached redox relays will be analyzed. Such mesoporous electrodes find applications in a number of devices, including dye-sensitzed solar cells, electrochromic displays, biosensors and lithium insertion batteries. Recently light emission under application of an external electric field has also been observed. The operation of these nanocrystalline systems will be analyzed and several examples presented.

Literature:

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