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Electrochemical properties of thiol-capped CdTe quantum dots

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Quantum dots (QDs) are semiconductor nanoscale inorganic crystals with unique size-dependent chemical and physical properties.Cyclic voltammetry measurements of QDs give information on the absolute energies of the valence and conduction bands (from the redox potential values) and electron-transfer processes involving the nanocrystal. According to this, the purpose of our study was cyclic voltammetry studies aimed at understanding the structural factors that regulate the redox properties of CdTe–CdS core–shell QDs.

A series of CdTe QDs of different diameters stabilized by thioglycolic acid were synthesized and their cyclic voltammetric behavior in aqueous solution was investigated. It was found that distance between the oxidation and reduction peaks increases with decreases QDs sizes. This trend is similar to what is observed in the optical measurements. However, it should be noted that the CV band gap energy (ΔE_{cv}) is 0,1 – 0,3 eV smaller than the optical ΔE_{op} in most cases. A reason for these disagreements may be related to the presence of surface defects that act as local trap states for electrons and holes. Also, the effects of scan rates on the parameters of redox processes involving CdTe QDs were studied. According to the obtained results band structure diagrams for different particle sizes were plotted.