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Modification of the CdS by thiol-containing agents for development of biosensors based on single crystal field-effect resistor

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Physical transduser of single crystal biosensor consists of microelectrodes and a one-dimensional single semiconductive nano- or microcrystal switched in the electric circuit. The crystal surface should be modified by chemical or biological selective agent, capable of reacting with a target substance: proteins, DNA, etc. The principle of the simplest biosensor based on one-dimensional conductor is that the selective adsorption of a charged target leads to dramatic changes in conductivity. If screening radius LD of semiconductive nanocrystal and crystal diameter are close, then we are dealing with one-dimensional conductive system with strong response of conductivity with external field change.

Unlike an existing technique of single crystal attaching to microelectrodes by micromanipulator and connecting into electric circuit by electron-beam lithography, the growth of semiconductor nanocrystals in the space between microelectrodes is a self-organizing process suitable for device manufacture.

Compounds A2B6 and A3B5 are promising classes of semiconductors for nanocrystals technology. Growth mechanisms of wurtzite nanocrystals specificity used for control of field-effect resistor topology.

Bioselective agent can be bound to the surface of nanocrystal of A2B6 compounds via thiol group. Chemisorption of model modifying agents (cysteamine and mercaptohexanol) on the surface of CdS has been studied by quartz crystal microbalance technique and gave experimental parameters for estimations of potential sensitivity of the biosensor. Modeling shows high sensitivity of the single crystal biosensor in order of 10-14 mol L-1.

Selection of chemical and biological selective agent, study of their chemisorption on the surface of the CdS nanocrystals, investigation of the process of interaction between immobilized bioselective agent and target molecules for for development of biosensors based on single crystal field-effect resistor are discussed.