Spontaneous Growth of Au Nanoparticles onto CdS, ZnS or PbS Thin Films for Electrochemical Immunosensors

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A facile method to fabricate Au-CdS (or ZnS, PbS) nanocomposites is reported. The method is based on spontaneous growth of Au onto the metal sulfide nanoparticles. Unlike typical synthesis of Au-semiconductor nanocomposites, this method does not require additional steps of introducing other reducing agents. Direct redox reactions occurs between Au(III) ions and metal sulfide nanoparticles. We have probed the Au-semiconductor nanocomposites by scanning electron microscopy (SEM), transmission electron microscopy (TEM), and X-ray diffraction (XRD). A possible mechanism was proposed for spontaneous growth of Au nanoparticles. It was found that H₂O₂ appeared to inhibit the Au growth onto the metal sulfide surface. We accordingly developed an enzyme-linked sandwich electrochemical immunosensor for the detection of human immunoglobulin G (IgG). In the electrochemical immunosensor, we use the glucose oxidase labeled antibody to generate H₂O₂ that inhibits the Au growth on CdS films, thereby decreasing the cathodic current at 0.9 V. This immunosensor can detect IgG as low as 1.5 ng/mL.

Keywords: Spontaneous growth; Au-CdS nanocomposites; metal sulfide

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