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Bimetallic Cu/Au Nanostructures and Bio-Application

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Bimetallic nanostructures have received tremendous interests as a new class of nanomaterials which may have better technological usefulness with distinct properties from those of individual atoms and molecules or bulk matter. They excelled over the monometallic counterparts because of their improved electronic, optical and catalytic performances. The properties and the applicability of these bimetallic nanostructures not only depend on their size and shape, but also on the composition and their fine structure. These bimetallic nanostructures are potential candidates for bio-applications such as biosensing, bioimaging, biodiagnostics, drug delivery, targeted therapeutics, and tissue engineering. Herein, gold-incorporated copper (Cu/Au) nanostructures were synthesized through the controlled disproportionation of Cu+-oleylamine complex at 220 °C to form copper nanowires and the subsequent reaction with Au3+ at different temperatures of 140, 220 and 300 °C. This is to achieve their synergistic effect through the combined use of the merits of low-cost transition and high-stability noble metals. Of these Cu/Au nanostructures, Cu/Au nanotubes display the best performance towards electrochemical non-enzymatic glucose sensing, originating from the high conductivity of gold and the high aspect ratio copper nanotubes with high surface area so as to optimise the electroactive sites and facilitate mass transport. In addition to high sensitivity and fast response, the Cu/Au nanotubes possess high selectivity against interferences from other potential interfering species and excellent reproducibility with long-term stability. By introducing gold into copper nanostructures at a low level of 3, 1 and 0.1 mol% relative to initial copper precursor, a significant electrocatalytic enhancement of the resulting bimetallic Cu/Au nanostructures starts to occur at 1 mol%. Overall, the present fabrication of stable Cu/Au nanostructures offers a promising low-cost platform for sensitive, selective, reproducible and reusable electrochemical sensing of glucose.

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Gold and Silver Nanoparticle Immobilized on Silicon Porous Matrix, Pores and Particles Size Control

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An enormous development is experimented on the porous materials. The porosity was considered a defect in solid materials some years ago, but right now, this defect is an advantage, based on the properties obtained from micro, meso and macroporous materials, and their possible applications on a medical field. The feasibility to use forming agents to control the density and size of the pores, and the possibility to improve the porous properties through adding functional groups or nanoparticles on the porous surface allow the application of porous materials in many areas, especially on medicine. The Porous materials could be made with the use of organic compounds that can act as templates or pore-forming agents, through a versatile non-surfactant route in which non-surfactant organic compounds such D-glucose, D-maltose, ascorbic acid, etc. Microporous, Mesoporous and Macro porous materials can be manufactured using many substances such as carbon, silicates, ceramics, minerals and polymers (silicone). Attached to the advantage of the porous materials, micro, meso and macro channels can be coated with metallic nanoparticles to further improve their biocompatibility properties. The surface modifications for polymers like Porous Silicon Matrix by applying coatings, or by using metal nanoparticles, increase the biocompatibility properties, prevent a nanofilms formation and favor interaction of living cells with the porous material, especially for its beneficial effect on cell adhesion and proliferation. Along with the control size porosity, the application of metal helps allow vascularization and the growth of cells inside. The silver and gold nanoparticles immobilized over the porous silicone matrix can be controlled to form a uniform film or a porous film, both options could be used for a medical application with a tremendous potential.

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