Physico-Chemical nanomaterials science

Seed mediated synthesis of giant gold particles on a solid surface

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Appearance of modern compact electronic devices requires development of bottom-up technology for manufacturing of elements for electronic circuits. Herein we present approach allowing to synthesize large gold particles, i.e. “gold contacts” directly on a solid surface.

Seeds of gold nanoparticles (AuNPs) were synthesized using Turkevich method. These NPs have spherical shape with the average size of 17±2 nm, as evidenced by h-TEM. Simultaniously the Nps with triangular shape (so-called “nanoprisms”) were observed. Stabilization of AuNP in solution due to negatively charged shell formed of trisodium citrate dehydrate (citrate) during synthesis. This shell prevents AuNP from aggregation in water solution and allows their grafting on pretreated glass surface by (3-aminopropyl)-triethoxysilane (Fig.1(top)) due to employing electrostatic interactions.

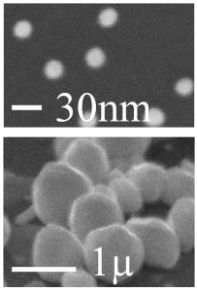

Figure 1. SEM images of AuNP seeds on glass (top) and giant particles (bottom)

For the synthesis of large gold particles, the glass slides were immersedfurther into a multicomponent solution of $HAuCl_4$ in glycerol, ethylene glycol and ethanol for 48h. The temperature of solution was constantly kept at 80ºC during synthesis. For stabilization of AuNPs and gold prisms formed either in a free volume solution or on the surface polyvinylpirrolidon was used.

The scanning electron microscopy (SEM) revealed formation of giant gold particles on a glass surface, which have quasi-spherical shape with the size of about 1μ (Fig.1(bottom)). The presence of flat gold nanoprisms on the surface we also observed. They can be attached from free volume solution by $-NH_3^+$ terminal groups of the glass surface or even grown directly on the modified surface.