Nanostructured surfaces

Incorporation of water into citrate shell of AuNP assemblies by neutron reflectometry

V.I.Petrenko[1,2], S.V.Snegir[3], O.P.Artikulnyi[1,2], V.Ye.Kutsenko[4], M.V.Avdeev[2], L.A.Bulavin[1]

[1]*Kyiv Taras Shevchenko National University, Volodymyrska str. 64, Kyiv, 01033 Ukraine*
E-mail: vip@nf.jinr.ru

[2] *Joint Institute for Nuclear Research, Joliot-Curie 6, Dubna, Moscow reg., 141980 Russia*

[3]*A.A.Chuiko Institute of Surface Chemistry, Nat. Acad. of Sci. of Ukraine, Gen. Naumov str. 17, Kiev, 03164 Ukraine*

[4] *Institute of Physics, Nat. Acad. of Sci. of Ukraine, Prospect Nauki, 46, Kyiv, 03039, Ukraine.*

Modern chemistry allows to design nano-scaled metallic pattern with preassigned electron conductance properties by grafting of nanoparticles on silicon surface. These properties are highly sensitive to many parameters: nature of the metal, shape, surrounding medium and adsorbate. Gold nanoparticles (AuNPs) attract much attention due to prospects of development of nanoelectronics and sensors on their basis. 'Turkevich method' allows to obtain citrate capped aqueous colloidal solution of AuNPs with spherical shape and relatively monodispersed by size, i.e. 17±2 nm [1]. However, for the moment it is unclear why such AuNPs can cover only 80% of the silicon surface pre-coated with (3-aminopropyl)-triethoxysilane (APTES).

The aim of this work was to study structure and composition of organic shell of AuNPs attached to silicon substrate via APTES. The AuNPs were synthesized by 'Turkevich method' using either H_2O or D_2O. The silicon wafers with the AuNPs were studied by neutron reflectometry. This method is highly sensitive for various isotopes/components and it`s possible to shadow/get signal from various components of the object (so called contrast variation method). The X-ray diffraction, atomic-force microscopy, high resolution tunneling microscopy were also used as complementary techniques to obtain accurate structural parameters of AuNPs shell.

1. *Louis C, Pluchery O.* Gold Nanoparticles for Physics, Chemistry and Biology: Imperial College Press; 2012.