

Poster Presentation

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Sandwich-like flat freestanding silicon nanocrystals

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For the first time we have obtained the sandwich-like flat freestanding silicon nanocrystals (nc-Si) as a result of synthetic procedure in colloidal solution: the outer layers are formed by the perfluorophenyl ligands and flat silicon nanocrystal is located between two ligand layers. The fact of binding of the perfluorophenyl ligands to the surface of silicon nanoparticles is supported by FTIR, EDS and XPS spectroscopy. Concentrations of the elements observed on the surface of samples were calculated for the separate lines appeared to be as follows: Si 11.0, O 17.0, F 3.2, Morphology and structure of the synthesized Si-nanoparticles were studied by Transmission Electron Microscopy (TEM). The samples comprise two types of nanoparticles: spherical and flat (2D structures). The average diameter of spherical particles is 4.0 ± 0.5 nm. Electron diffraction pattern (DP) demonstrates that spherical Si-nanoparticles are amorphous. Along with halo-like DP from spherical particles, the spot diffraction patterns from some areas are observed for flat nanoparticles which have the crystalline structure. The experimental DP is in a good agreement with the simulated diffraction pattern for cubic Si phase. analysis of electron diffraction data indicates that thickness of these particles is less than 10 nm. The size of these particles can reach 50 nm. The thickness of flat nanocrystals was evaluated by Atomic Force Microscopy (AFM) also: it appeared to be close to 3.3 nm in average what is thrice smaller than that determined by TEM. This difference will be discussed. Lamellar nanocrystals are possibly formed at the stage of replacement of the bromide ligands by perfluorophenyl groups and are the products of aggregation of spherical silicon nanoparticles in flat plates. Growth of the plates is caused by C...F specific interactions between the ligands, which result in formation of layers of the perfluorophenyl ligands due to their self-assembly in fluorophobic media.

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