Nanocomposites and nanomaterials

Specificity of Core & Shell Type Nanocomposite Formation under the Rotation-Corrosion Dispergation Conditions

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The appearance of core & shell type nanocomposites based on magnetite and precious metals enhances their practical usage in comparison with single phase particles due to the combination of physical-chemical properties of both core and shell materials [1]. In general, core & shell type structures are formed via interaction of separately formed core and shell components by means of organic substances; or reduction of shell species on the core surfaces; or performing one stage red-ox reaction.

Recently we have proposed a new method for obtaining of nanoparticles, including core & shell type structures, on the steel surface in the open-air system that was called the rotation-corrosion dispergation (RCD) [2]. The feature of such phase formation process lies in the appearance of strong reducing agents Fe(II)-Fe(III) layered double hydroxides or Green Rust (GR) on the steel surface and their interaction with the aquaforms of precious metals. As a result, LDH structures are transformed into magnetite particles, whereas dissolved argentum or aurum species are reduced into silver or gold shells, on the magnetite surface by oxidation of ferrous iron in the $Fe^{2+}Fe^{3+}{}_2O_4$ (Fe_3O_4) lattice.

At the same time free entrance of air oxygen into the system leads to fast oxidation of GR precursor and its solid state transformation into lepidocrocite or Fe(III)-GR [3]. Also, the development of additional oxyhydroxide phase significantly complicates the applying of nanocomposite sols in biological and medical research. Hence, to obtain pure core & shell composite dispersions the RCD process must be carried out under reductive conditions or when the oxidation of the system is limited.

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3. *Legrand L., Mazerolles L., Chaussé A.* The oxidation of carbonate green rust into ferric phases: solid-state reaction or transformation via solution // Geochim Cosmochim Acta. -2004.-**68.**-P. 3497-3507.