Nanocomposites and nanomaterials

Synthesis of surface-free monodisperse copper nanoplates

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The dependence of the size and size distribution of copper nanoplates synthesized by a facile solution-phase polyol process on the starting concentration of Cu^{2+} was investigated. It was determined that the nearly monodisperse copper nanoplates with the mean diameter 1.1–1.4 m and thickness 70–90 nm can be synthesized via the reduction of 0.15 mM $CuSO_4$ ethylene glycol solution by hydrazine even in the absence of stabilizers at 30 ^{0}C. Using the method of energy dispersive X-ray spectroscopy it was determined that obtained particles do not contain copper oxide and any organic impurities.

Using the turbidimetric method kinetics of formation of copper nanoplates has been investigated. It was established that the all kinetic curves of Cu^{2+} reduction by hydrazine are sigmoidal and described properly by Finke-Watzky two step mechanism (FW2) of slow continuous bimolecular nucleation then fast surface growth [1] which indicates the autocatalytic nature of the process.

The effective rate constants of pseudoelementary FW2 reactions were calculated. The comparison of SEM analysis and kinetic data allow to suggest that the coagulation of particles during their growth is inhibited due to high viscosity of solution and the size and size distribution of obtained copper nanoplates is controlled by kinetic parameters of their nucleation and growth.

1. *Laxson W. W., Finke R. G.* Nucleation is second order: an apparent kinetically effective nucleus of two for $Ir(0)_n$ nanoparticle formation from $[(1,5\text{–COD})Ir^{I}\cdot P_2W_{15}Nb_3O_{62}]^{8-}$ plus hydrogen // J. Am. Chem. Soc.-2014.-**136.**-P. 17601-17615.