Physico-chemical nanomaterials science

Hierarchical structuration of the "green" silver nanoparticles in time of mesoscopic ordering in the channel of mesostructured TiO_2 films

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Nanoparticles can serve as a model system to the effects of quantum confinement on optical properties, widely exploited for use in photonics, surface-enhanced Raman scattering etc. The properties of nanoparticles are mainly determined by its size, shape and structure. Thus, one could control any one of these parameters to fine-tune the properties of this nanoparticle. The synthesis of "green" nanoparticles is characterized by processes that occur close to ambient temperature. In case of mesoscopic film, we can realize orientation of host 1D or 2D nanostructures as a promising strategy for tuning the properties of nanoparticles. Self-assemble of nanoparticles in the pore channel allowed construct hierarchical assemblies with specific properties. We are reporting the controlled formation of Ag nanostructures generated from the self-assembly and stabilized in solution by proteins secreted by the fungus Fusarium oxysporum.

Fig. 1. The QCM plots in situ illustration of kinetics of morphogenesis green nanoparticles.

UV-VIS, FTIR, TEM, SEM, AFM was used for characterization of nanoparticles and composite films. An original method in situ for monitoring the hierarchical structuration of Ag nanoparticles and characterization decomposition kinetics based on a quartz crystal microbalance (QCM) sensor platform was used. Obtained kinetics of morphogenesis green nanoparticle was critical for one-pot sol-gel method of fabrication of Ag/TiO_2 composite films and its application. These nanocomposite showed attractive electronic and photocatalytic properties, in particular coatings, and SERS application. The QCM method has been shown to be an effective approach for analyzing the chemistry and kinetics of morphogenesis of complex “core shell” nanoparticles.