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Synthesis of Silver Nanostructures on Different Supports: From Nanoparticle Decoration to a Complete Shell Growth

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Abstract

In this work, we investigate a complete strategy to obtain supported silver nanostructures (AgNSs) which can be used for different applications such as catalysis, optoelectronics, and biomedical devices. Given the poor wetting of silver on many support materials, the anchorage of silver nanoparticles (AgNPs) to the substrate (decoration) is achieved by employing an oxide precipitation-decomposition method. This protocol is optimized to obtain rapid and homogeneous decoration of AgNPs on different substrates such as silica, titania, and hydroxyapatite with a negligible production of free-standing silver nanoparticles. Going a step further, we have also studied the growth of AgNPs attached to silica spheres (SiO2NPs) using a seed-mediated growth strategy. The interplay of different processes like growth, corrosion, coalescence, and sintering determines the morphological features of the grown nanoparticles. Therefore, the substrate coverage and nanoparticle morphology can be qualitatively modified by varying the composition of the growth bath. The observed growth is consistent with a radial growth mechanism which, in most

experimental conditions, allows for the production of anisotropic AgNSs onto silica surface. In addition, if the corrosion effects are minimized, the coalescence process of neighboring particles can lead to high surface coverages.

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