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ORIGINAL CONTRIBUTION

Truncated and spheroidal Ag nanoparticles: a matter of size transformation

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Abstract The ordered arrays of anisotropic mesostructure metal nanoparticle (diameter size in the range of 15 to 200 nm) characteristics are indeed influenced by the combined effect of packing constraints and inter-particle interactions, that is, the two morphological factors that strongly influence the creation of the particles' shape. In this work, we studied on how the degree of truncation of Ag nanoparticles authorised the mesostructured morphologies and particle orientation preferences within the mesosparticle arrays. The Ag represented the best and most versatile candidate and known for its highest electrical conductivities among other transition metals in periodic table. The interest is motivated by the need to understand the inevitable morphological transformation from mesoscopic to microscopic states evolve within the scope of progressive aggregation of atomic constituents of Ag system. The grazing information obtained from HR-TEM shows that Ag mesosparticles of highly truncated flake are assembled in *fcc*-type mesostructure, similar to the arrays formed by microscopic quasi-spherical structure, but with significantly reduced packing density and different growth orientations. The detailed information on the size and microstructure transformation have been gathered by fast Fourier transform (FFT) of HR-TEM images, allowing us to figure out the role of Ag defects that anchored the variation in crystallite growth of different mean diameter size particles. The influences on the details of the nanostructures have to be deeply understood to promote practical applications for such outstanding Ag material.

Keywords Mesostructures · Ag nanoparticles · HR-TEM · Microscopy, electron · Crystallite growth · Morphology

Introduction

Recently, the use of metallic nanoparticles as a cornerstone of many advanced materials for frontier applications in several competitive technological fields ranging from quantum electronics to biomedical and catalysis have received increasing attention as the results of their outstanding properties [1–9]. A critical control regarding the synthesis protocols is dedicated entirely to the design of metal mesostructured (mean diameter size in the range of 100 down to 10 nm) and their synthesis routes. On that note, the explanation of synthesis protocols is capable in demonstrating the principal growth activity and innovative crystallisation pathways that are of the primary matter. The hierarchical structures that yield the properties of the materials can be tuned precisely by nanoparticle sizes which represent the versatile route to induce the oriented arrangements of different nanostructure materials. A large variety of structural types is influenced by the variation of inter-particle interactions such as dipolar, van der Waals interactions as well as modification of the surrounding capping agent shells.

As a matter of fact, in the case of individual pure metal structures, which have been widely investigated by many

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