3D CRYSTAL GROWTH OF SILVER NANOCRYSTALS USING NEAR CRITICAL FLUID PROCESSING

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The ability to assemble organized array of metal nanocrystals over a long range is of growing interest since these mesoscopic materials exhibit physical properties that differ from those of either the bulk materials or single atoms. These arrays of nanocrystals give the possibility to probe both individual and collective properties [1-4], resulting from the relative positioning of the nanocrystal in the substrate. Tailoring the properties of such ordered nanostructure represents a future direction in metal science.

Several methods ranging from self-assembly [5-9] to nanomanipulation with a scanning probe microscopy [10] have been proposed to achieve complex two-and even three dimensional structures of nanocrystals. Currently, however the nanocrystals self-assembly is the only proven method for achieving these structures with dimensions at least one order of magnitude smaller than those obtained using lithographic techniques.

This is the first report of organized silver nanocrystals in long range using near supercritical fluid processing. In fact, one is able to control the solvent properties by tuning the temperature and pressure. This provides a new way of growth. We show for the first time that the pressure can be used as a new parameter to control the assemblies of nanocrystals. The crystallographic structure of the nanocrystal superlattice is investigated by small angle X-ray scattering.

Silver nanosized particles were synthesized by using reverse micelles as described previously [8]. The nanoparticles obtained present an average diameter of about 3.4 nm with 13% as size distribution. The fabrication of nanocrystal superlattices was performed using a near critical process described in ref [11]. The evaporation process occurs under near critical conditions of temperature and pressure for CO_2 [11].

The supracrystal made of silver nanoparticles obtained under these conditions are characterized by SEM which show large terraces (figure 1). The ordered structure of these supracrystals is obtained by small angle X-ray scattering [11].

Figure captions

Figure 1- SEM micrographs of supracrystals of silver nanocrystals grown under near critical conditions of temperature and pressure for CO_2.

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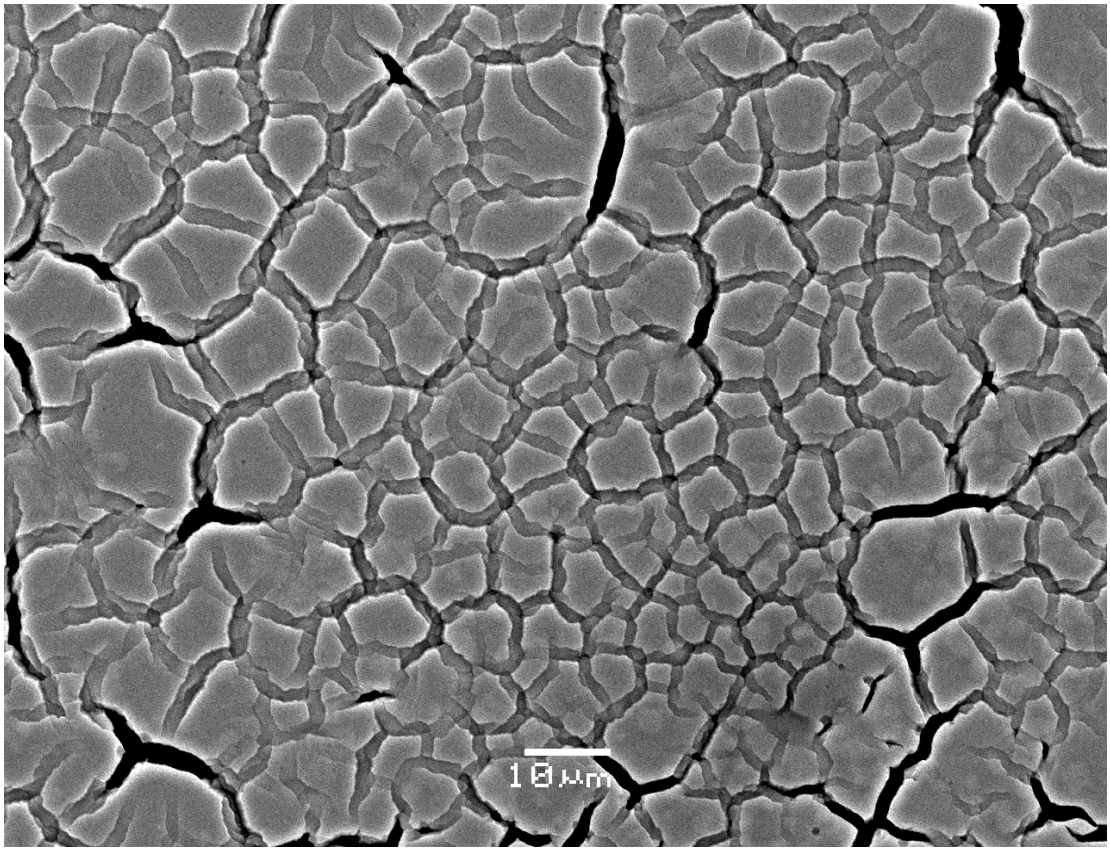

Figure 1