Influence of the CuO nanoparticles surfaces into assembly of Al/CuO nanothermites

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Among energetic materials, nanothermites are known for their high reactivity and thus used for pyrotechnic applications. One of the promising material for integration into micro devices is Al/CuO nanocomposite because of its high enthalpy of oxidation-reduction reaction [1]. Increasing the contact surface between both components of the thermite composite should lead to improved properties. The control of the particles size, the morphology and the distribution of the nanoparticles inside the composite is therefore of paramount importance.

Recently, we developed an original approach for the preparation of such Al/CuO composites. This approach consists in the formation of the CuO nanoparticles by the controlled hydrolysis and/or oxidation of an organometallic precursor (*i.e.* copper amidinate), in the presence of capping ligands, (*i.e.* octylamine) [2]. Small CuO nanoparticles (ca. 5 nm) are obtained. These latter are associated with metallic Al particle using specific organic linkers, leading to the formation of CuO/Al aggregates in solution. Advantageously, this approach leads to colloidal solutions compatibles with inkjet printing technique.

The surface state of the CuO nanoparticles turns to be of paramount importance for the nanothermite preparation. Analysis through NMR, FTIR and Raman spectroscopies evidence species and their role on the stability of the colloid over time. In addition, structural information is obtained using wide angle X-ray scattering (WAXS). Structural differences are observed highlighting the importance of the synthetic route. The formation of the resulting aggregates is followed by dynamic light scattering (DLS) measurements and the heat capacity released by the system is measured by differential scanning calorimetry (DSC) experiments.

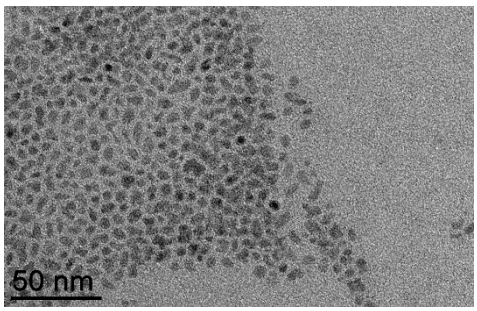

Figure 1. TEM image of CuO nanoparticles synthetized by hydrolysis in the ambient air of the copper amidinate precursor.

References:
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