Functional CuO and ZnO nanoparticles using water-in-oil reverse micelles

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Abstract

Nanoparticles have deserved considerable attention in the last decade as additives in lubricating oils to reduce friction and wear between two rubbing surfaces [1]. Conventional nanoparticle additives are easily oxidized, block oil pipelines and may sediment. Consequently, the development of new chemically stable nanoparticles with improved tribological properties is an area of paramount technological interest.

In this work, we describe the synthesis of CuO and ZnO nanoparticles in water-in-oil microemulsions [2-4] in order to control the size and morphology of the nanoparticles [Figure 1]. Functionalization of these nanoparticles was performed by a reverse titration method in which a microemulsion prepared using $NH_{3(aq)}$ as aqueous media and other microemulsion containing an aqueous solution of the metal salt were mixed. During the mixing, a continuous stirring was used to keep the solution clear. After 30 min reaction and aging for 24 h, a blue (for copper) or a white (ZnO) precipitate was obtained, which was dried by heating the system at 70-80ºC. The functionalization was done using a hydrocarbon chain, trimethoxy(octyl) silane which, in turn, was a functional group of the micellar structure [Figure 2]. This approach allowed a 'one-pot' reaction: nanoparticle synthesis and its concomitant functionalization as the microemulsion droplets acted as nanoreactors.

The synthetized nanoparticles were characterized by FTIR, TEM and fluorescence. As can be seen (Figure 3), TEM images of CuO nanoparticles revealed that individual particle is near spherical in shape with average nanoparticle size of ca. 7 nm. In addition, the powder showed good dispersity.

References

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[4] Vuk Uskokovic and Miha Drofenik, Surface Review and Letters, Vol12, No. 2, **Synthesis of materials within reverse micelles** (2005), 239-277

FIGURES

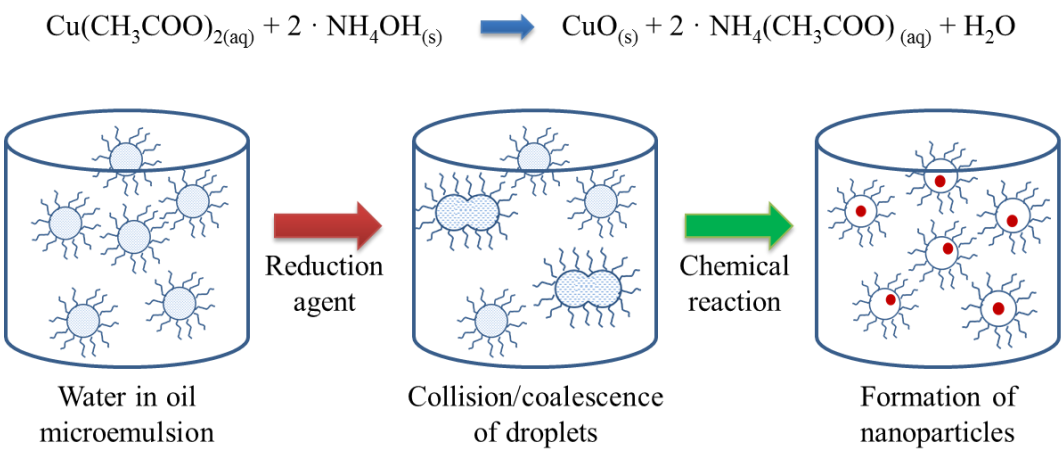

Figure 1. Synthesis of CuO nanoparticles inside of reverse micelle

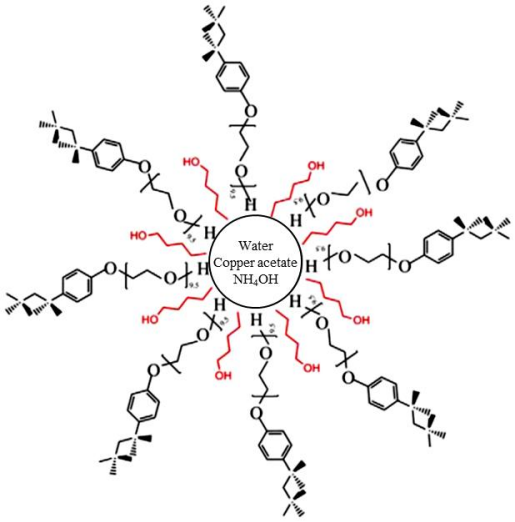

Figure 2. Structure of the functional reverse micelles

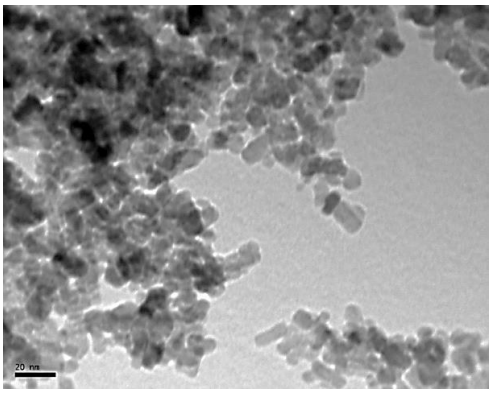

Figure 3. TEM image of CuO nanoparticles. Size and morphology