EXPERIMENTAL EVIDENCE OF THE EXISTENCE IN SOLUTION OF ORGANIZATIONS OF ZnO NANOPARTICLES SYNTHESIZED BY ORGANOMETALLIC METHOD USING DYNAMIC LIGHT SCATERRING

Myrtil L Kahn, Carole Pagès, André Maisonnat, and Bruno Chaudret

Laboratoire de Chimie de Coordination, UPR8241 CNRS, 205 route de Narbonne, 31077 Toulouse Cedex, France.

Corresponding author: Myrtil L Kahn, Fax 0033561333179, email: myrtil.kahn@lcc-toulouse.fr

Zinc oxide is a material of particular interest because it possesses unique optical and electronic properties. It is a wide-band-gap semiconductor (3.37 eV) that is also luminescent and emerged as a good candidate for many applications. As a result ZnO stimulates research in a wide range of domains. For example, thin films of ZnO were reported to display good conductivity and high transparency in the visible region and have been envisaged as transparent electrodes for solar cells[1a] as well as gas sensors,[1b] and recently, ultraviolet lasing effect has been observed at room temperature using ZnO nanowires.[1c] These fascinating examples are based on the control of both the physical and chemical properties of the nanoparticles. Besides, it is well known that these properties depend on the synthetic method used and as a consequence, applications of nanomaterials are directly linked to the successful control of the synthetic process.

We recently developed a novel organometallic synthetic method for the preparation of crystalline ZnO nanoparticles of controlled size and shape.[2] Tendency of the nanoobjects to self-organize onto the T.E.M. grid is observed.

This contribution concerns the field of the fundamental understanding of the self-assembly of nanoparticles to form superlattices in solution. We demonstrate the existence of superlattices of nanoparticles in solution and that this formation is indeed a thermodynamic process. We also pointed out the important role of weak interactions (Van der Walls, dipolar and hydrogen bounding) for the stabilization of the superlattices.

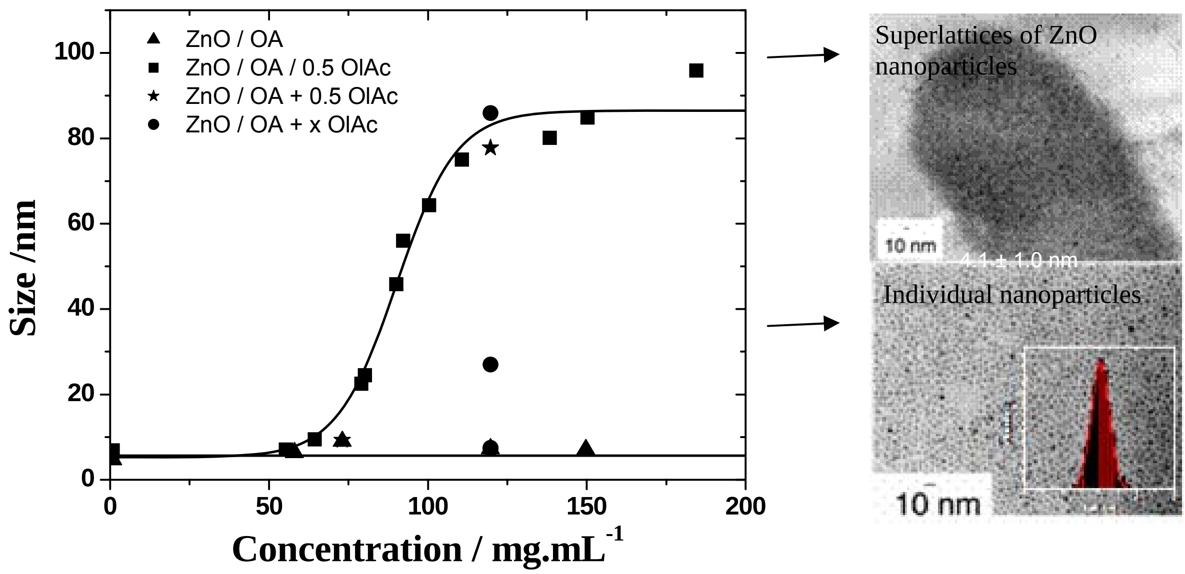

Figure 1: Variation of the size of the diffusive objects as a function of the concentration of the colloidal ZnO solutions. ▲: Colloidal solution of OA-stabilized ZnO nanoparticles; ■: Colloidal solution of OA/OlAc-stabilized ZnO nanoparticles; ●: Colloidal solution of OA-stabilized ZnO nanoparticles with a step by step addition of OlAc; ★: Colloidal solution of OA-stabilized ZnO nanoparticles with 0.5 eq of OlAc for two different concentrations.

References:
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