BOOK CHAPTER 8

o-Phenylenediamine encapsulated silver nanoparticles and their applications for organic light-emitting devices

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Abstract

Quantum-size (< 10 nm) metal nanoparticles (NPs) have attracted a great deal of interest for a variety of applications (Gittins & Caruso, 2001; Brust & Kiely, 2002), many of which require that the particles be water-soluble (Ackerson, et al. 2005; Kim, et al., 2005; Bao, et al. 2003; Manna, et al. 2001) or remain suspended in water with no loss of their physical or chemical properties over extended periods of time. In addition, many applications require colloidal precipitation (Li, et al. 2005; Pan & Rothberg, 2005; Haes & Van Duyne, 2004) of these NPs to allow them to be film-cast using suitable solvents. The choice of synthetic methods and precursor elements are vitally important for determining the phase (watersoluble or colloidal precipitation) of the NPs. Water-based syntheses of NPs, however, are fraught with problems that result from ionic interactions, which are typically overcome by using very low reactant concentrations (ca. 1× 10-4 M)(Ahmadi, et al. 1996). Moreover, diffusion, which is much faster in aqueous solutions, can lead to aggregated metal NPs in the absence of a stabilizer (Rele, et al. 2004). In contrast, particles synthesized in suitable organic solvents can be prepared at relatively high concentrations of reactants (Sun & Xia, 2002), with predefined sizes and shapes (Gree & O'Brien, 1999; Pileni, 1998), and with improved monodispersity relative to that of NPs prepared in aqueous solutions. Here, we describe the preparation of stable, monodisperse, quantum-sized silver nanoparticles (NPs) in water soluble form through a simple one-pot procedure that uses glycerol for reducing Ag+ in the presence of o-phenylenediamine (o-PDA).