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Chemical Synthesis Methods for Controlling Morphology and Achieving Uniform Arrays of Metal Nanoparticles in Semiconductor Films

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Abstract. The optical properties of metal nanoparticles are significantly influenced by their morphology, and varying of their shape leads to the appearance of a number of interesting properties. The presence of sharp edges and vertices in nanoparticles with non-spherical shapes, such as polyhedral, pentagonal and, in particular, icosahedral, leads to enhanced electric-field confinement. Enhanced optical and electrical properties of nanoparticles and semiconductor films with embedded nanoparticles make them promising for various applications, including photovoltaics, optoelectronics, and light-emitting devices. Since the properties of nanoparticle-based nanocomposites are determined not only by the morphology of nanoparticles, but also by their distribution in the film volume, it is necessary to develop methods for producing nanoparticles with the possibility of controlling and varying their morphology, as well as their introduction into semiconductor films to obtain uniform arrays. This article gives a review of relevant studies, the main focus is on chemical synthesis, as one of the most common methods for producing metal nanoparticles.

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