

Light, a powerful tool for the synthesis of metal nanoparticles and nanocomposites

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The size dependent properties of noble metal nanoparticles (MNPs) have created a great promise because of their use in a variety of optical, electronic and biomedical applications. Nowadays, a great diversity of techniques and methods were developed for their synthesis: chemical, thermal, photochemical or biological. Among them, the photochemical approach has proven an excellent tool to synthesize nanoparticles and also nanocomposites materials as well in the investigation of the mechanistic aspects of their formation. Moreover, this “green” and “highly flexible” approach allows a sharp spacial and temporal control of the chemical reactions. Thus, photochemistry is used to produce MNPs through the photo reduction of a metal precursor by transient species arising from the photocleavage of a radical generator in aqueous solution or directly on a glass surface in order to produce plasmonic surfaces. Improving the efficiency of the process and controlling the NPs morphology require a careful optimization of the photonic and chemical parameters. This innovative photochemical approach

was also used to design advanced nanomaterials such as metal/polymer nanocomposites. Hybrid nanocomposites were obtained by combing the in situ photoreduction with the photopolymerization of multifunctional acrylate monomers. In such systems, specific interactions between the macromolecular network and nascent particles was found to control the access of metal atoms to the different crystalline planes of the growing particles, which is necessary to obtain anisotropic nanoobjects. The ultimate step of this photochemical approach is concerned with the spatial assembling of MNPs in the polymer matrix. Thus, controlling both the synthesis and multi-scale organization (nano, micro and macro) of such cross-linked organic-inorganic nanomaterials opens promising prospects in the field of advanced materials.

Biography

Lavinia Balan obtained her PhD degree from the University Henry Poincaré in Nancy, France, in 2005. Her PhD was devoted to the elaboration of an original material for the anode of Li-ion batteries. Since 2006, she is a CNRS Senior Researcher. Her lines of research are concerned with photo chemical synthesis and design of metal nanoparticles and metal/polymer nanocomposites for advanced applications. She holds five patents, published more than 90 papers in reputed journals and is a member of 10 editorial boards of journals in the field of nanomaterials and nanotechnology.

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