Plasmonic nanoparticles under irradiation

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Abstract

Metallic nanoparticles (NPs) with dimensions of the order of tens of nm have received much attention in recent years. This is due to the plasmonic particles they exhibit, in particular, the strong surface plasmon resonance associated to nanoparticles of noble metals (Ag and Au). When embedded in dielectric matrix (typically silica), the nanoparticle shape can be strongly modified by the passage of swift heavy ions. More specifically, starting with an ensemble of spheres, prolate spheroids can be obtained this way, with the larger axis aligned along the ion beam direction. The resulting elongated nanoparticles can be used for a number of applications.

Although, the swift ion irradiation-induced elongation effect has been extensively studied [1–5] and some theoretical models have been proposed [1–3], the origin of the deformation is not yet fully understood. In order to follow in detail the elongation process, we have exploited in this work, the strong dependence of the surface plasmon resonance on the particle shape and size [6]. Thus, in situ optical absorption measurements allow us to follow the deformation kinetics of Ag spheres. In addition to the fundamental information obtained to understand the phenomenon, the method allows us to monitor the process, which ultimately constitutes a very valuable tool to modify at will the optical properties with a high degree of control.

References

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