Ultra-stable silver nanocolloids for antimicrobial applications

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The application of metal and metal oxides in the form of nanostructures, to enhance physicochemical properties of materials, has increasingly attracted the interest of materials scientists in different fields. Among other features, these nanomaterials show a broad antimicrobial activity and can be advantageous to design bioactive coatings and/or surfaces with controlled metal ion release. In recent years, we have developed and deeply characterized many different nanoantimicrobial systems[1-3] as a powerful alternative route to fight bacterial resistance towards conventional antibiotics and disinfecting agents. In this study, bioactive silver nanoparticles (AgNPs) were produced as ultra-stable nanocolloids by means of laser ablation synthesis in solution (LASiS)[4]. The AgNPs were synthesized in isopropanol in absence of additional capping agents. Remarkably, it was found that they are stable with respect to both aggregation and silver oxidation over more than 90 days. The rationale behind this extreme stability of AgNPs suspended in organic solvents was investigated. On the basis of theoretical considerations and basic experiments it is proposed that the stabilization of AgNPs involves the formation of an organic coating generated by the interaction of isopropanol molecules with the pulsed, high-energy laser beam[5]. As shown in TEM micrographs (Figure 1), both fresh and aged NP agglomerates appeared surrounded by a thin low-contrast layer, ascribable to organic matter. UV–Vis spectra, X-ray photoelectron spectroscopy (XPS) results, as well as the hydrodynamic radius and the ζ-potential values of AgNPs will be presented, in order to assess the stabilization role of organic shell around NP agglomerations.

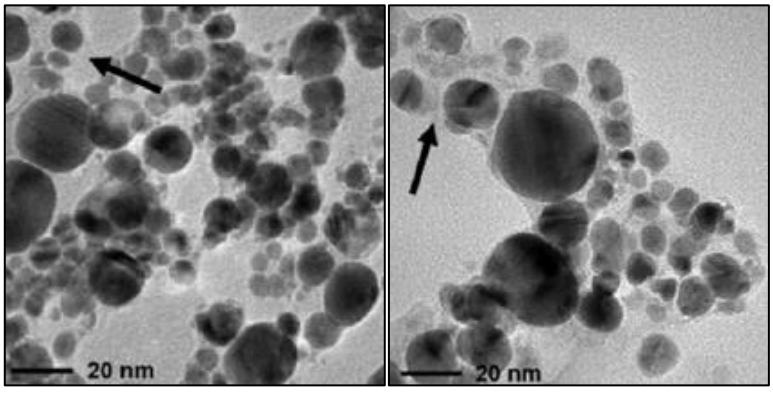

Figure 1. TEM images of fresh (left) and aged (right) AgNPs.

References

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