Extended Abstract

Synergistic Effects in Nanoparticle-Based Protective Coatings for Paper and Textiles [†]

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Superhydrophobic materials have attracted considerable attention during the last decades, since they allow the facile transfer of special wettability properties on various surfaces. Protective coatings that ensure water repellency on a solid surface became the most common way for the treatment of stone or concrete buildings, metal devices, glass, textiles, etc. [1]. Most of these materials are nanohybrids consisting of a filmogenic matrix with various nanoparticles as fillers, with the main role being to obtain a suitable roughness. In this work, a superhydrophobic coating based on a combination of ZnO and Ag nanoparticles embedded in a silica matrix was obtained and synergistic effects in antibacterial and other properties were investigated. Coating materials were prepared with various contents of ZnO and Ag nanoparticles embedded in an organo-modified (Ormasil) silica matrix. Ag nanoparticles were synthesized using a “green chemistry” method based on the reduction of silver ions in *Thymus vulgaris* extract. Zinc oxide nanoparticles were synthesized by using hydrothermal synthesis in high-temperature/high-pressure conditions, in the presence of surfactants as structuring agents. Commercially available normal-type paper and cotton textile were used as the model solid substrate to be functionalized. Ag and ZnO nanoparticles were characterized from the point of view of size, surface potential, crystallinity, and shape using dynamic light scattering, XRD, scanning electron microscopy (SEM), and transmission electron microscopy (TEM). The coating materials were prepared by adding various concentrations of Ag and of ZnO nanoparticles in a filmogenic silica matrix. The silica nanohybrid was obtained through the sol–gel method, and the deposition of coating material was performed by brushing or spraying onto a solid surface previously functionalized with chitosan. The contact angle of water on modified surfaces of both paper and textile materials was in the range 150–160°, with sliding angle of less than 7°. A synergistic effect between ZnO and Ag nanoparticles was observed in terms of antibacterial activity, but no synergism with the chitosan was proved. Superhydrophobic multifunctional materials were obtained with reduced content of both Ag and ZnO nanoparticles. The coatings show

superior antibacterial activity due to the synergistic effect from the nanoparticulate components, together with UV-protection and self-cleaning properties.

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