Characterization of nanoparticular coating solutions by means of High Resolution Electron Microscopy and X-Ray Diffraction

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Nanosized silver particles are used as antimicrobial agents, in modern Plasmon-based optics or catalysis. For antimicrobial applications, e.g. to prevent healthcare-associated infections, silver particles are especially useful, since they exhibit a high biocide efficiency against a broad range of germs and only a small tendency to resistance formation is observed. Composite materials, containing silver are also important for medical applications for example as silver refined textile fabrics for the treatment of atopic dermatitis or for additional skintherapy of patients with diabetes.

Surface functionalisation of temperature-sensitive substrates, like textiles, polymerfoils or paper, can be achieved from chemical solutions. Since a thermal after-treatment of the coating for crystallization is restricted by substrate decomposition, it is essential to develop coating solutions already containing the functional crystalline species in nanoparticular form. Therefore solvothermal preparation as well as reflux preparation in the presence of suitable reductive agents are convenient approaches.

For structural and morphological characterization of such nanoparticular coating solutions Transmission Electron Microscopy (TEM) in particular High Resolution Transmission Electron Microscopy (HRTEM) and X-ray diffraction (XRD) are useful methods.

Ag and Ag/SiO_2 sols containing nanocrystalline silver particles have been investigated with respect to crystallite size and particle morphology. We found different morphologies of Ag particles and in sols, where Ag^+ was only partly reduced under the solvothermal conditions chosen, also $AgNO_3$ particles were identified. Process conditions of the solvothermal synthesis have been optimized by systematically screening with XRD and TEM in combination with chemical analysis. Optimized sols have been applied to textile fabrics, and their antimicrobial and photocatalytic properties have been investigated.

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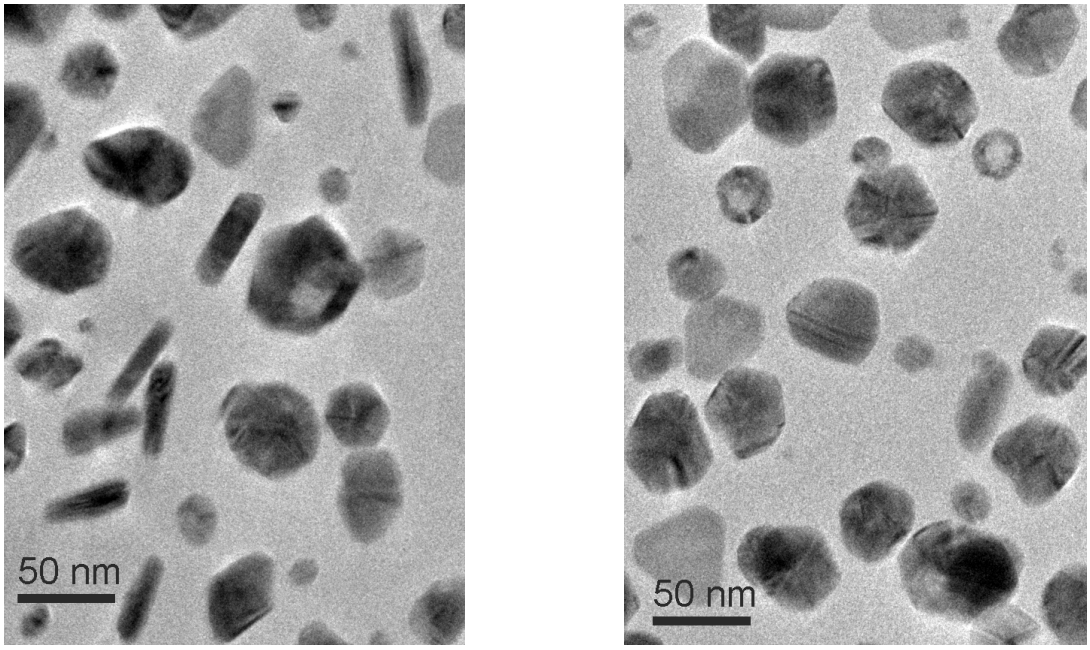

Figure 1. TEM images of solvothermally prepared Ag sols

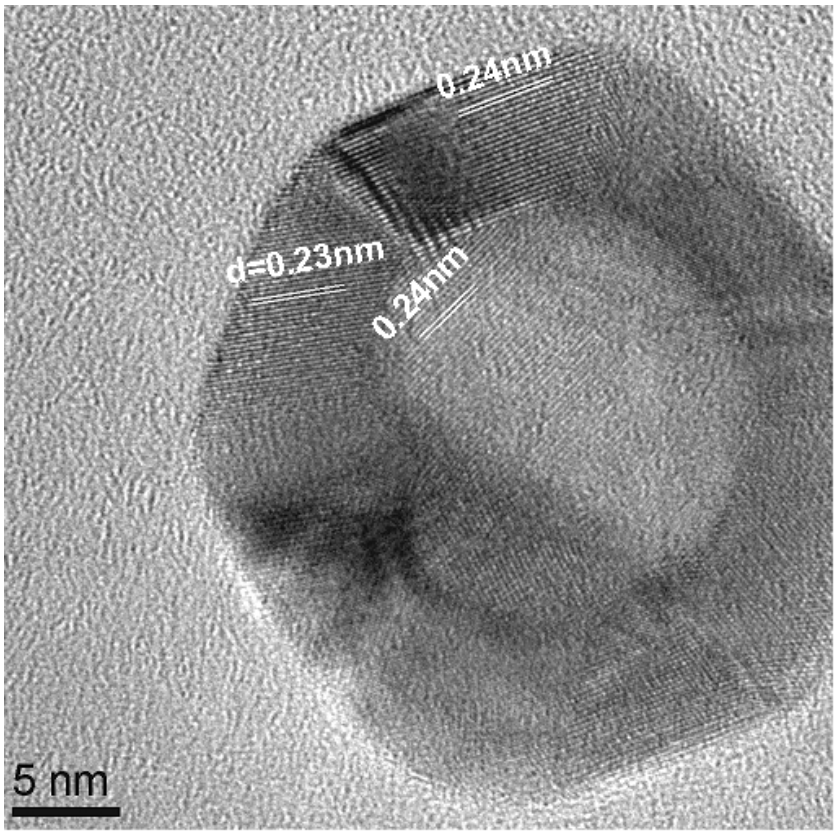

Figure 2. HRTEM image of a Ag particle in solvothermally prepared Ag sols taken with the Cs-corrected Tecnai F20 Cs-corr. (111) lattice planes are idendified (d = 0.2359nm).

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