BACTERIAL SURFACE LAYERS (S-LAYERS) AS BUILDING BLOCKS FOR PHOTOCATALYTIC NANOCOMPOSITES

K. Pollmann[1], J. Raff[1], A. Marquard[1], A. Scholz[2]

1) Institute of Radiochemistry, FZ Dresden-Rossendorf

2) Institute of Ion Beam Physics and Material Research, FZ Dresden-Rossendorf

Nanoscaled materials comprised of organic and inorganic components are becoming more and more important in nanotechnology due to the diversity of applications. Self-assembling organic systems as part of such a hybrid material can be used as template for the fabrication of arrays of inorganic nanoparticles. Especially the proteinaceous bacterial surface layers (S-layers) that envelop bacterial cells are attractive for fabricating and patterning of nanostructures. These proteins are composed of protein monomers with the ability to self-assemble into two-dimensional arrays. The regular distributed pores of these paracrystalline arrays work as binding sites for various metals and offer ideal structures for the formation of regular distributed metallic nanoclusters of a defined size [1]. Such arrays are very attractive for technical applications ranging from the development of novel catalysts to biomedical applications, the programmed assembly of nanometre scale electronic devices, and optical industry [2]. Another approach is the embedding of S-layer proteins into ceramics thus producing metal binding functionalized nanocomposites [3].

Here we present the synthesis and characterization of S-layer templated ZnO-nanoclusters of a size of 16 nm. The photocatalytic properties of ZnO-particles are interesting for the application as nanoscaled catalytic material. We used these nanoparticles for photocatalytic degradation of the parmaceutical Diclofenac at a wavelength of 365 nm. The widespread occurrence of pharmaceutical residues such as Diclofenac in the environment has been reported in numerous investigations [4], thus establishing these compounds as a new class of pollutants. Therefore, the need of novel technologies for removal of these compounds has become evident. Our future work will concentrate on the development of photocatalytic active nanocomposites by the use of S-Layer produced ZnO-particles.

[1] Wahl, R. et al. (2001). Adv. Materials 13, 736-740

[2] Pollmann, K. et al. (2006). Biotechnol. Adv. 24, 58-68

[3] Raff, J. et al. (2003). Chem. Mater. 15, 240-244

[4] Wiegel, S. et al. (2004). Chemosphere 57, 107-126