FUNCTIONALIZED NANOPARTICLES: INTERACTION WITH POLYMERS AND POLYMER SURFACES

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Abstract

Photochemical reactions in polymers that change the chemical reactivity of the irradiated areas are widely used for applications such as patterning of photoresists, immobilization of (bio)molecules on surfaces, electroless plating of plastics, and improving adhesive properties of surfaces. Generally, photolithographic techniques provide the possibility to obtain patterns with submicrometer resolution. In this study we report on photoreactive polymer films that offer the possibility of a patterned immobilization of amino functionalized silicon dioxide (SiO2)- nanoparticles. For that reason a photoreactive polymer containing benzyl thiocyanate (SCN) groups has been synthesized. The thiocyanate groups in the side chain undergo an isomerisation reaction upon irradiation with UV-light which results in chemically reactive isothiocyanate groups (NCS) in the illuminated areas. The photo generated NCS-moieties react easily with the amino groups in the ligand shell of the SiO2- nanoparticles. Therefore, SiO2- nanoparticles could be selectively immobilized in these areas by moistening the polymer surface with a SiO2- nanoparticle solution. Depending on the time of the moistening, different amounts of SiO2 were deposited on the illuminated areas, while no immobilization of SiO2-nanoparticles was observed in the non-illuminated areas. By using photolithographic masks, patterned SiO2 structures were obtained on the polymer surface. Without any optimisation, resolutions of 20 µm were achieved in these experiments. On-going research aims at patterns with even higher (sub µm) resolution of SiO2-NP at polymer surfaces. Furthermore, a derivatisation of aminofunctional SiO2-NP is aimed at in order to expand the spectrum of (photo) chemical reactivity.

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