

CATIONIC POLYMERISATION WITH MODIFIED UPCONVERSION NANOPARTICLES

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Upconverting Nanoparticles (UCNPs) doped with Lanthanoids generate UV light by multi-photon absorption of NIR radiation. The emitted UV light at 345 nm and 362 nm can be used for radiation curing of monomers with suitable photoinitiators.^[1] Cationic curing systems UCNP stabilized with oleic acid failed, which can be related to nucleophilic anions in the system.^[2] Modification of the UCNP with a silica shell in a microemulsion process and optimization of the monomer mixture can overcome those disadvantages and facilitates sufficient polymerisation.

Following from this we investigated the use of functionalized silanes like Azidoundecyltriethoxysilane, which enabled binding of suitable photoinitiators on the particle surface. A shell of functional silanes like Azidopropyltriethoxysilane is built up on the particle surface and a Thioxanthone derivative comprising an alkyne group is bound to the particle by an Azide Alkyne click reaction. The binding of the Photoinitiator on the surface of the UCNP enables the direct absorption of the emitted light without attenuation while travelling through the matrix of the curing system. This system system was found as useful to cationic polymerization of several epoxies.

[1] Oprych, D.; Schmitz, C.; Ley, C.; Allonas, X.; Ermilov, E.; Erdmann, R.; Strehmel, B., Photophysics of Up-Conversion Nanoparticles: Radical Photopolymerization of Multifunctional Methacrylates Comprising Blue- and UV-Sensitive Photoinitiators. *Chemphotochem* **2019**, 3 (11), 1119-1126

[2] Oprych, D.; Strehmel, B., Mediated Generation of Conjugate Acid by UV and Blue Sensitizers with Upconversion Nanoparticles at 980 nm. *Chemistry – A European Journal* **2020**, doi:10.1002/chem.202005076