PLATINUM-COMPLEXED SCNPS: THE FIRST REUSABLE HOMOGENOUS CATALYSTS IN CHEMICAL REACTIONS

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ABSTRACT

Single-chain nanoparticles (SCNPs) consist of only one polymer chain that is folded via an induced intramolecular collapse-process. Various pathways are known to induce the single-chain collapse including linkages via hydrogen-bonding, covalent bonds or the addition of external linker molecules for instance metal-complexes. To date, SCNPs are capable of completing complex tasks, such as sensing, information storage, self-healing systems or in catalysis.

Herein, we present the formation of platinum-complexed SCNPs which can be employed as reusable homogenous catalysts in the amination of allyl-alcohols. A copolymer consisting of styrene and diphenylphosphino-styrene was folded by dropwise-addition of the precursor compound $Pt(COD)Cl_2$. The successful coordination of platinum as well as the collapse into nanoparticles with a reduced hydrodynamic radius was confirmed via SEC measurements, DOSY, DLS, ^{1}H NMR- $^{31}P\{^{1}H\}$ NMR- and ^{195}Pt NMR spectroscopy. After characterization, the Pt-complexed SCNPs were used as homogenous catalysts in the aminiation of aniline and its derivates with ally-alcohols. Isolation and separation of the SCNPs was performed by changing the polarity of the solvent of the reaction mixture which led to precipiation of the SCNPs. After zentrifugation and filtration of the SCNPs, their folded state was again confirmed by NMR spectroscopy and SEC measurements.

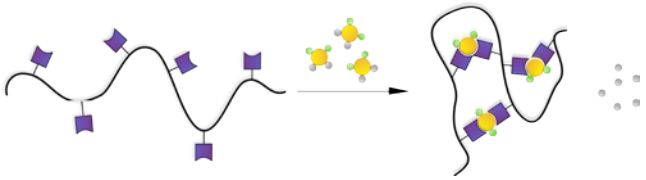

Fig. 1: Schematic representation of the folding of a single polymer chain into a SCNP via addition of metal-complexes (yellow dots). Grey dots represent former ligands that are cleaved-off during complexation of the metal-ion with the polymer chain.

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