

POLYMER SURFACE MODIFICATION OF NANOPARTICLES: MAKING OF FUNCTIONAL COMPOSITE NANOMATERIALS

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Carefully controlled core-shell nanoparticles are desired as functional transducer materials in applications ranging from optics to biomedicine, as well as to improve properties of polymer materials as additives. While these properties are provided by or transduced by the (inorganic) particle core, the interactions with the environment are controlled by the shell surrounding the core. In all applications, nanoparticles must be individually and homogeneously dispersed in a matrix, since aggregation is detrimental and leads to a loss of the desired properties. State-of-the-art surface modifications of nanoparticles are grafted polymer shells, which are tuned to provide the required physical and chemical compatibility for dispersion in the environment. We report on progress in the design and synthesis of polymer-grafted nanoparticles, achieved through rigorous control of the grafting, topology and morphology of the polymer shell. These allow the control not only of dispersion in liquid (solvent and polymer) matrices, but also self-assembly into functional superstructures. This progress is exemplified using e.g. superparamagnetic nanoparticles with responsive polymer shells that can respond to external magnetic stimulus in superstructures to change material properties, and extended to show the versatility of the approach also to incorporate nanomaterials in composite materials through polymer melts.