

Prof. Dr. Ulrich Schubert
Vienna University of Technology
Institute of Materials Chemistry

Bottom-up Synthesis of Nanocomposites from Molecular Building Blocks

Silica gels with incorporated metal oxide or metal nanoparticles can be prepared by controlled post-synthesis treatment of gels containing covalently bonded metal complexes. To this end, metal compounds, as the precursors for the metal particles, are tethered to $\text{Si}(\text{OR})_3$ groups by means of a coordinating organic group. After sol-gel processing, the nanocomposites are obtained by thermal, photochemical or chemical post-synthesis treatment of the gels by which the organic tether is removed and/or the metal ions are de-coordinated with concomitant growth of the metal oxide or metal particles.

Polymeric films with highly dispersed inorganic clusters as nanosized building blocks were prepared from pre-formed metal oxide/alkoxide clusters of the general formula $\text{M}_x\text{O}_y(\text{OH/OR})_v(\text{carboxylate})_w$ with unsaturated carboxylate ligands. Polymerization of small proportions of the clusters with organic co-monomers results in hybrid polymers in which the clusters crosslink the polymer chains. The properties of the new hybrid materials originate from a combination of nanofiller and crosslinking effects in addition to the intrinsic properties of the base polymer and the inorganic cluster.