

RECENT PROGRESS ON PHOTOPOLYMERIZATION OF COMPOSITES

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The presentation will give an overview of the activities carried out at the EPFL to produce a diversity of polymer composites based on photo-induced polymerization processes, with focus on organic-inorganic hybrids (OIH) and interpenetrating phase composites (IPC). OIH represent a class of materials based on integrative and bio-inspired synthetic strategies as alternatives to conventional polymer processing and soft chemistry routes. Various formulations with organic (e.g., multifunctional acrylates and epoxies) and organometallic precursors (e.g., tetraethyl orthosilicate) and preformed nanoparticles such as silica were subjected to a dual-cure condensation and photopolymerization processes. The dynamics of network formation was investigated using novel photo-hyphenated methods such as photo-rheology and photo-calorimetry. Applications examples include diffusion barrier coatings and wear-resistant bio-inspired surfaces. IPC also represent an important class of materials with enhanced thermomechanical properties compared with their non-IPC analogues. Two different IPC based on polyurethane (PU) and aluminium open-cell foams impregnated with an epoxy formulation were produced using a radical photoinduced cationic frontal polymerization process. Different concentrations of a cationic photoinitiator and a thermal initiator on the frontal polymerization features, in particular the exothermic reaction was systematically evaluated.