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OVERCOMING OXYGEN INHIBITION EFFECT BY TODA IN ACRYLATE-BASED SUSPENSIONS OF ALUMINUM OXIDE NANOPARTICLES

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Photo-polymerization reaction presents several advantages such as rapid curing process, providing low temperature and low energy conditions, besides non-polluting and solvent-free formulation. The main challenge in free-radical photo-polymerization of acrylates is that oxygen inhibits polymerization and results in decreasing the polymerization reaction. For decades, ceramic fillers have been used to enhance mechanical properties of polymeric matrices. Dispersing inorganic fillers in the polymer matrix uniformly without agglomeration of the nanoparticles is an important issue. The presented research investigates the effect of TODA (2-[2-(2-Methoxyethoxy) ethoxy]acetic acid) (as a steric stabilizer) on photo polymerization degree and mitigation of oxygen inhibition mixture of acrylate monomers and respectively the ceramic enhanced ink. The TODA concentration was changed from 0 to 40 v% in the formulation of the matrix and ink. Matrix consists of combination of acrylate monomers (EEEA, PEGDA, PETA and PETRA), photoinitiator, TODA, and alumina nanoparticles (35 nm), exclusively in the ink formulation. The weight ratio between photoinitiator and monomer was 3/97. Samples were coated on glass, followed by exposing to UV light for 30 s (0.17 W/cm², 4.1 J/s, 395 nm). In addition, in order to compare curing behaviour of the matrices and ceramic-filled inks in air and inert atmosphere, the samples were cured under argon atmosphere at the same curing conditions as in air. Fourier Transform Infrared (FTIR) spectroscopy and pressurised differential scanning calorimetry (P-DSC) were performed to investigate the polymerization degree of the materials. For investigation of agglomeration of the alumina nanoparticles in the acrylate matrix, particle size distribution of the nanoparticles in suspension was measured by using a Particle Metrix NANO-flex®. Due to the presence of ether groups in TODA structure, by incorporating 20-40 v% of it into the system, full photo polymerization of acrylate in air atmosphere was achieved. Besides this, due to the steric stabilizer effect of TODA for aluminum oxide nanoparticles, it overcomes agglomeration of the aluminum oxide nanoparticles in the suspension.

Biography

Nazila Rostami is pursuing her PhD in Johannes Kepler University in Polymer Science Institute. She is currently a Research Engineer at Profactor, working on several projects on Inkjet Printing, Curing and Sintering Processes.

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