Fabrication and characterization of photocurable inorganic-organic hybrid materials using organically modified colloidal-silica nanoparticles and acryl resin

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Abstract : Photocurable inorganic-organic hybrid materials were prepared from colloidal-silica nanoparticles synthesized through the sol-gel process and using acryl resin. The synthesized colloidal-silica nanoparticles had uniform diameters of around 20 nm, and they were organically modified, using methyl and methacryl functional silanes, for efficient hybridization with acryl resin. The organically modified and stabilized colloidal-silica nanoparticles could be homogeneously hybridized with acryl resin without phase separation. The successfully fabricated hybrid materials exhibit efficient photocurability and simple film formation due to the photopolymerization of the organically modified colloidal-silica nanoparticles and acryl resin upon UV exposure. The fabricated hybrid films exhibit an excellent optical transmission of above 90% in the visible region as well as an enhanced surface smoothness of around 1 nm RMS roughness. In addition, the hybrid films exhibit improved thermal and mechanical characteristics, much better than those of acryl resin. More importantly, these photocurable hybrid materials fabricated through the synergistic combination of colloidal-silica nanoparticles with acryl resin are candidates for optical and electrical applications.

Key Words : Sol-gel Processes; Organic-Inorganic hybrids; Transmission Electron microscopy; Atomic Force Microscopy