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Author Jeng-Chin Jiang
Author's Email Address No Public.
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Abstract Abstract
In this study, a highly transparent epoxy, DGEBA (diglycidyl ether of bisphenol-A) and a clear anhydride, 4-methyl hexahydrophthalic anhydride (MHHPA), was cured by a tertiary amine catalyst (C11Z-CN). A sol-gel process was employed to convert tetraethoxysilane into a SiO2 inorganic network, which was interpenetrating with the epoxy organic network. Thermogravimetric analysis (TGA) was used to determine the extent of SiO2 formation, while optical microscope or TEM were used to observe the development of the morphology for this organic-inorganic hybrid. After carefully studied the effect of reaction conditions, several interesting reaction formulations and processes were identified to prepare a transparent epoxy-based organic-inorganic interpenetrating network. Furthermore, strong acids, HCl, TSA and weak acids, MHHPA, CH3COOH were used separately to catalyze the sol-gel reaction of TEOS. The sol-gel reaction was carefully studied by changing the reaction temperature and the content of H2O.The results showed that the formation of inorganic particle size were in the range of 5~50nm. TEM were used to observe the development of the morphology of silica particles both in the inorganic phase and in the organic-inorganic hybrid. While HCl could produce silica particle quite rapidly, the particle were easily aggregated and resulted in an organic-inorganic hybrid with opaque appearance. By introducing solvent, such as THF or IPA, the particle size was then reduced to nano-scale with very homogeneous dispersion. As for MHHPA, the organic-inorganic hybrid thus prepared is transparent. However, the yield of silica was not as high as that obtained by HCl system.
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