Norbornene end-capped polyimide/mesoporous SiO_2 nanocomposites exhibiting low dielectric and reduced residual stress constants

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In this study, a series of norbornene end-capped polyimide/mesoporous SiO2 nanocomposite films were synthesized by using a 3,3'4,4'-Benzophnonetetracarboxylic (BTDA), 4,4'-diaminodiophenyl (ODA), norbornene, and mesoporous SiO2 through thermal imidization. For mesoporous SiO2, NaSiO2 and cethyltrimethylammonium bromide (CTABr) were used to yield a defined pore which was then confirmed using wide angle x-ray diffraction (WAXD), Fourier transform infrared spectroscopy (FTIR), and transmission electron micrographs (TEM). The PI/mesoporous SiO2 composite films were successfully investigated by FTIR. The morphological structures of the PI/mesoporous SiO2 composite films were characterized by WAXD and FTIR. The 5% decomposition and glass transition temperature of PI/mesoporous SiO2 composite films were measured using thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and their residual stress behavior was investigated by thin film stress analyzer (TFSA).