

The preparation and characteriation of highperformance poly(imide-silica) hybrid

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Abstract

Two types of the poly(amic acid) were prepared from the polycondensation with 3,3',4,4'-benzophenonetetracarboxylicdianhydride(BTDA), 4'',4'''-(Hexafluoroisopropylidene) bis(4-phenoxyaniline) (4'',4''' -HF BAPP) and 3-aminopropyltrimethoxysilane (APTMS). One was pure poly(amic acid) and the other was silane end-capped poly(amic acid). In this study, Tetraethyl Orthosilicate (TEOS) was used for generating inorganic polymer with the structure of Si-O-Si bond and was reacted with silane end-capped poly(amic acid) for organic-inorganic hybridization via the sol-gel process by adding some pure H₂O. For the analysis, they were analysed by FT-IR, TGA, prism coupler, Dielectric constant analyzer and water sorption Cahn valance.

Organic-inorganic hybrids were synthesized with the different wt % of TEOS via sol-gel process and their cured films were all transparent. FT-IR results, all peaks of the functional groups of imide ring were shown and certified that the hybrids were synthesized well without any phase separation between organic and inorganic. At the range of 1000~1200 cm⁻¹ and 800~850 cm⁻¹, The specific peaks network confirmed as the Si-O-Si and the intensity of the peaks was enlarged with the augmentation of wt% of TEOS. The refractive indices' range of these hybrids was 1.5990~1.5700. Increasing the wt % of TEOS to polyimide matrix, the refractive indices decreased. Each of the dielectric constant values which were calculated by Maxwell equation and measured by Dielectric constant analyzer decreased from 2.694 to 2.4561 and from 2.79 to 2.51 with increasing the inorganic precursor, TEOS. The 5% and 10% decomposition temperature range of hybrids were 490.14~513.29°C and 514.22~529.04°C.

At the end, for the water sorption of hybrid films, the amount (%) of water sorption into hybrid films also decreased with the augmentation of weight (%) of TEOS into polyimide.

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