Intermolecular Interactions of Polyimides Containing Benzoheterocyclic Moieties

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Abstract

Polyimides (PI) containing benzoheterocyclic groups in the main chain have been synthesized using diamines having benzimidazole or benzoxazole unit in our laboratory. It was observed these performed moieties imparted outstanding properties to the polyimides. Moreover, glass transition temperatures (T_g) of PIs containing benzimidazole units exceeded those containing benzoxazole units by at least 40^{o}C. It was inferred that benzimidazole units led to higher degree of intermolecular interactions. In this part of work, infra-red spectra and thermal analysis were carried out to investigate the intermolecular interactions of polyimides containing benzimidazole or benzoxazole unit. Band shifts were found for -NH- group of benzimidazole unit and imide carbonyl group by FT-IR spectra of PI films derived from benzimidazole-type diamine, which confirmed stronger intermolecular associations for polyimide chains containing benzimidazole moiety; low-molecular imide model compounds were synthesized to simulate the intermolecular forces between the polymer chains, thermal analysis showed that the compound based on benzimidazole-type diamine possessed higher melt viscosity and sublimation temperature, indicating the positive role that benzimidazole unit played to enhance the intermolecular interaction between the model compound molecules; polyimide films were prepared based on diamines containing these two units and biphenyl tetracarboxylic dianhydride isomers, T_g differences ($\triangle T_g$) between the polyimides based on benzimidazole unit and that derived from benzoxazole unit decreased monotonically as the steric impedance, which was induced by the isomer substitution fashion of the dianhydrides, increased, implying again that polyimides containing benzimidazole group had higher degree of intermolecular interactions.