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Soluble Polyimides from Unsymmetrical Diamine Containing Benzimidazole-Ring and Trifluoromethyl Pendant Group

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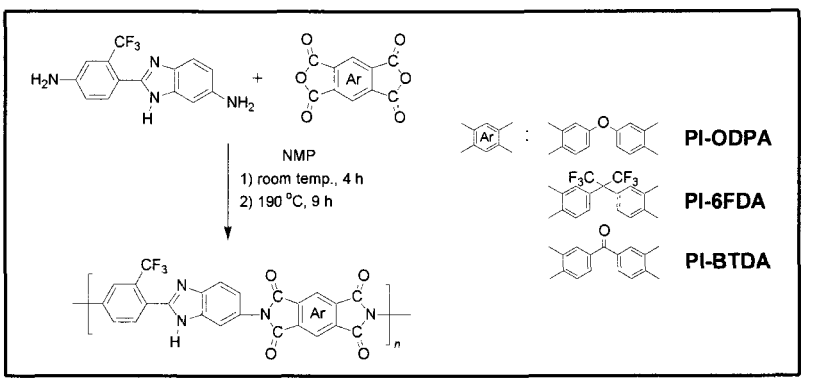
Aromatic polyimides are well-known as highly heat-resistant materials and have been widely used in many applications such as electronics, coatings, composite materials, and membranes.[1] Polyimides are often insoluble and infusible in their fully imidized form due to their rigid chain characteristics, leading to processing difficulties. Thus, polyimide processing is generally carried out with poly(amic acid) intermediate and then converted to polyimide via rigorous thermal treatment.[2] However, this process has several inherent problems such as emission of volatile byproducts (e.g., H_2O) and storage instability of poly(amic acid) intermediate.[3] To overcome these problems, much research effort has been focused on synthesis of soluble and processable polyimides in fully imidized form without deterioration of their own excellent properties. Several approaches to soluble polyimides including introduction of flexible linkage or bulky substituents and use of noncoplanar or alicyclic monomers have been developed.

In this study, new unsymmetrical diamine monomer containing both bezimidazole-ring and trifluoromethyl group, 6,4'-diamino-2'-trifluoromethyl-2-phenylbenzimidazole, was prepared and polymerized with ODPA, 6FDA, and BTDA by using one-pot synthetic method to obtain corresponding polyimides. All the rigid rod-like polyimides were soluble in polar aprotic solvents. Incorporation of trifluoromethyl groups unsymmetrically in the rigid polyimides improved their solubility without decreasing their physical properties. The polymers showed high glass transition temperature (T_g = 289-352 °C), high thermal stability (T_{d10} > 500 °C), and relatively low coefficient of thermal expansion (CTE = 26.1-46.4 ppm/°C) due to their rigid-rod like structure. Also, they showed low refractive indexes (n=1.64-1.68) and low birefringence (0.02).



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