P-1-10

Fully Aliphatic Polyimides from Adamantane-Based Diamines Possessing Enhanced Thermal Stability, Solubility, and Transparency

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Polyimides represent one of the most important classes of polymers in the microelectronics and photoelectronics industries. Aliphatic and alicyclic polyimides are becoming increasingly important material for optoelectronics and interlayer dielectric materials because of the better colorless transparency and the low dielectric constant. Unlike aromatic polyimides they hardly form inter or intra molecular charge complexes, which increase the dielectric constant and lower the transparency. Due to their bulkiness, diamond like adamantyl moieties is effective to decrease molecular density, giving polyimides with a low dielectric constant.

In this work we have synthesized a series of fully aliphatic polyimides (APIs) from bicyclo [2,2,2]oct-7-ene-2,3,5,6-tetracarboxylic dianhydride (BOCA) and various aliphatic diamines, including linear aliphatic, flexible alicyclic, and rigid adamantyl diamines. These high-temperature, one-step syntheses were performed in *m*-cresol and high-molecular-weight APIs that had intrinsic viscosities between 0.18 and 0.56 dL/g were obtained. The resultant polyimides possess good transparency, enhanced solubility, low dielectric constants, and high thermal resistance. These properties were enhanced in copolyimides containing equimolar amounts of rigid and flexible moieties. These rigid-rod APIs derived from the alicyclic dianhydride and aliphatic diamines are promising candidates as advanced materials for future applications in micro- and photoelectronic devices.