Abstract

Synthesis and Characterization of Aromatic Polyimides
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Thermally stable polyimides provide long-term services at elevated temperature. However, the processability of this polymer is difficult due to insolubility in common organic solvents and high melting temperature. Therefore, synthetic efforts have been taken to modify the structure of these polymers with the aim of improving their processability without sacrificing the thermal stability.

The objective of this research was to synthesize polyimides, poly(etherimide)s, poly(esterimide)s and poly(amideimide)s with improved processability by incorporating flexible groups (-O-, -SO₂- and -C=O), isopropylidene groups, pendant groups and 1,3-substituted phenyl ring in the polymer backbone, making use of newly synthesized novel monomers. Selected polymers were studied for possible applications as insulation materials for high temperature electrical insulation.

Two diamine monomers containing flexible groups (-O-, -SO₂- and -C=O), and isopropylidene groups were synthesized. A series of polyimides were synthesized from diamines and dianhydrides. Polyimides were amorphous and showed excellent solubility in common organic solvents. These polyimides exhibited high thermal stability. The polyimides have electrical insulation characteristics and the polyimides films can be used as insulation material in electrical items operating at elevated temperatures and for systems operating at lower temperatures.
Two bis(nitrophthalimide)s monomers containing flexible groups (-O-, -SO₂-and -C=O,) were synthesized. A series of poly(etherimide)s were also synthesized from these new monomers. X-ray diffraction study showed that the poly(etherimide)s were amorphous. The amorphous characteristics were well reflected in the solubility. The poly(etherimide)s exhibited good thermal stability. The poly(etherimide)s have electrical insulation characteristic and the films can be used as insulation materials for electrical items, cables, generators, electric motors, and parts operating at elevated temperatures.

Four AB type hyroxy nitro monomers were synthesized and used to derive poly(etherimide)s by polycondensation reaction. All the poly(etherimide)s were amorphous and showed good solubility and thermal stability. The poly(etherimide)s prepared have satisfied all the required properties.

Six diimide-diols monomers were synthesized. A series of poly(esterimide)s were synthesized from diimide-diols and aromatic diacid chlorides monomers. These poly(esterimide)s showed excellent solubility and thermal stability.

Two diimide-diacids monomer containing hexafluoroisopropylidene and ether units were synthesized. A series of poly(amideimide)s synthesized from these new diimide-diacids monomers and aromatic diamines exhibited high thermally stability and solubility.

The polyimides, poly(etherimide)s, poly(esterimide)s and poly(amideimide)s synthesized in the present study exhibited excellent thermal stability, good processability and other required properties. These properties can make these polymers as promising processable high performance polymers with wider industrial applications.