Original
Received March 5, 2020
Accepted for Publication May 17, 2020

Synthesis and Properties of Hyperbranched Aromatic Polyimides via Thermal Self-Polycondensation

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The thermal self-polycondensation of 4-(3,5-bis(4-aminophenoxy)phenoxy)phthalic acid, an AB_2 type monomer, proceeded successfully at 140°C to form a hyperbranched poly(amic acid). The subsequent chemical imidization of the poly(amic acid) afforded hyperbranched aromatic polyimides bearing acetylamide (**HBPI-Ac**) or imide terminal (**HBPI-Im**) groups. The formation of high molecular weight polymers was confirmed by gel permeation chromatography measurements using a light scattering detector. The resulting polymers exhibited good solubility and low solution viscosity, which is typical for hyperbranched polymers. The degree of branching of **HBPI-Ac** was determined to be 0.48. Moreover, the ^{1}H NMR measurement of the model phthalic acid compound at 120°C suggested that the formation of carboxyl anhydride units facilitated the amide bond formation, resulting in the hyperbranched poly(amic acid). **HBPI-Im** showed the temperature for a 5% weight loss at 470°C, which was much higher than that of **HBPI-Ac** (400°C). **HBPI-Im** film, coated on a glass plate, became insoluble in amide solvents after heating at 280 °C for 10 min, indicating that it could be applied as a solvent-resistant and thermally stable coating in the microelectronics industry.

Keywords : hyperbranched polyimide, thermal self-polycondensation, degree of branching, thermal stability coating film