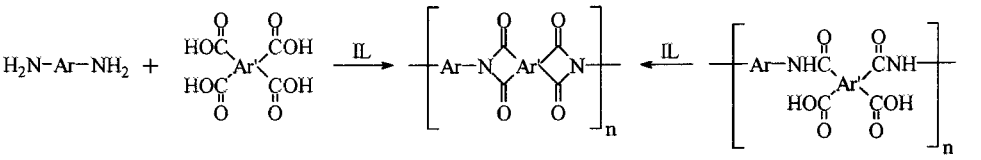
Synthesis of Polyimides using Ionic Liquids as Condensation Agents and Medium

Masaru YONEYAMA, Yuichi MATUSI, and Satosi MORIZUMI
Department of Biological and Chemical Engineering, Faculty of Engineering, Gunma University
Tenjin-cho 1-5-1, Kiryu, Gunma 376-8515, Japan

Wholly aromatic polyimides are well-known as thermal-stable engineering polymers and applied as protection and insulation layers in manufacturing semiconductors [1]. In general, polyimides are prepared via poly(amic acid)s from aromatic diamines and dianhydrides. By the way, we have found previously that polyamides could be synthesized from diamines and diacids in ionic liquids (ILs). In this reaction, ILs acted as condensation agents. Here, it is discussed that polyimides are prepared from diamines and non-active tetra-acids in ILs. Cyclodehydration of poly(amic acid)s using ILs is also determined.



The condensation reaction of aniline with phthalic acid in 1-butyl-3-methylimidazolium bromide ([bmim][Br]) at 150Åé for 12 h provided only N-phenylphthalimide in 73% without N-phenylphthalamic acid. It was thought that [bmim][Br] has high catalytic and condensation ability to activate carboxylic acids. The polycondensation of 1,3-bis(4-aminophenoxy)benzene and 3,4,3',4'-diphenylsulfonetetracarboxylic acid were carried out in various conditions such as four ILs containing imidazolium cation ([bmim][Cl], [bmim][Br], [bmim][BF_4], [bmim][PF_6]), temperature, time. Polyimides could be obtained in high yields using [bmim][Br] at 180Åé for 24h, while polymerization proceeded heterogeneously. Lower temperature gave polyimides with poly(amic acid) structure
The cyclodehydration of poly(amic acid)s in [bmim][Br] were also studied at lower temperature than conventional thermal cyclodehydration temperature (250-400Åé). The treatment of poly(amic acid)s in [bmim][Br] at 150Åé for only 30 min provided the complete transfer to polyimides.

References

[1] D. Wilson, H.D. Stenzenberger, and P.M. Hergenrother Ed., "Polyimides", Blackie, New York (1990).

Correspondence : e-mail yoneyama@bce.gunma-u.ac.jp; TEL +81-277-30-1482; FAX +81-277-30-1409