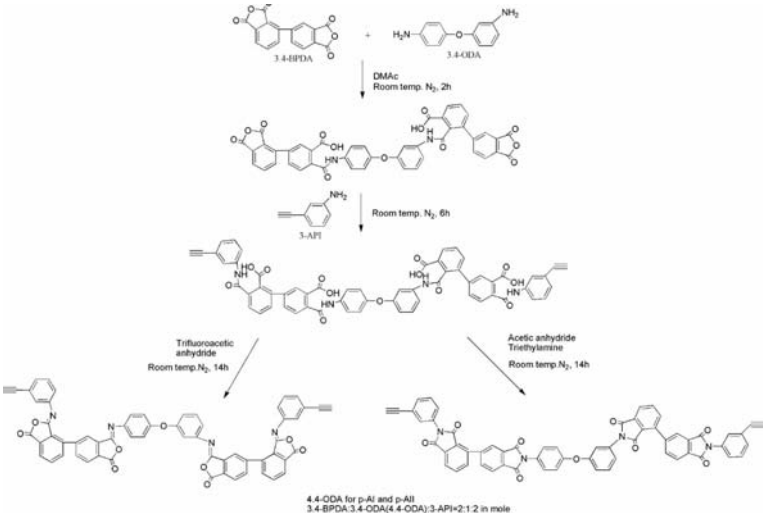
Polyisoimides based on 3, 4'-BPDA with Excellent Processability and Properties

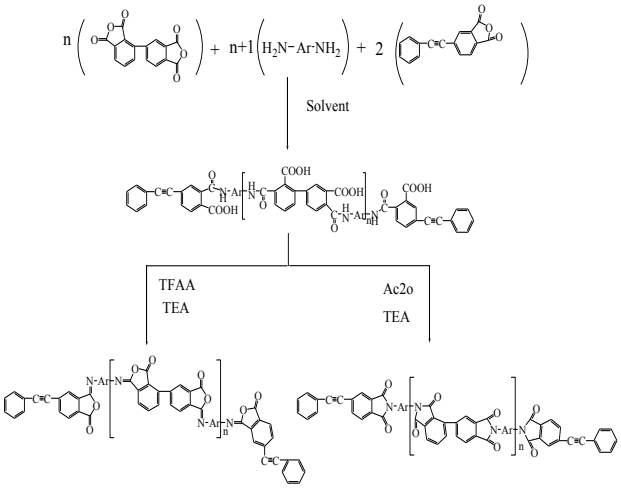
Zhen Wang, Xiangsheng Meng, Heng Zhou,Weifeng Fan, Mengxian Ding
Laboratory of Polymer Composite Engineering , Changchun Institute of Applied Chemistry,
Chinese Academy of Sciences, Changchun 130022, P. R. China

Abstract: Novel acetylene-terminated and phenylethynyl-terminated isoimide oligomers are synthesized by using trifluoroacetic anhydride as dehydrating agent. The isoimide structures were confirmed by Fourier transform infrared spectroscopy. The isoimide oligomers were amorphous. Some of them showed excellent solubility in many common solvents, such as acetone and tetrahydeofuran. DSC and plat rheometer are used to study crosslinking behavior and processability of those oligomers. The isoimide oligomers exhibit considerably wider processing window and low viscosity. The curing temperature of acetylene-terminated isoimide is lower than phenylethynyl-terminated isoimide about 100 ^{o}C, which could reduce the cost of high temperature composite's factoryprice. The effect of different treatment temperature on melt viscosity and solubility of oligomers is discussed. The results show that the effect of treatment temperature on melt viscosity of PII is little but a few effect on solubility. As expected, the isoimide form can be converted to imide form through thermal treatment, which can be demonstrated by FTIR. After curing the oligomers, the polyisoimides have good thermal stability similarly with polyimides from thermo-gravimetric analysis, also as high T_g as polyimides from DMA. This isoimide resin may be a good candidate as matrix or adhesive for high performance polymeric materials.

Key words: polyisoimide, polyimide, processability, thermal properties, structure--property relations



Scheme 1 Synthesis of acetylene-terminated oligomers



Scheme 2 Synthesis of phenylethynyl-terminated oligomers

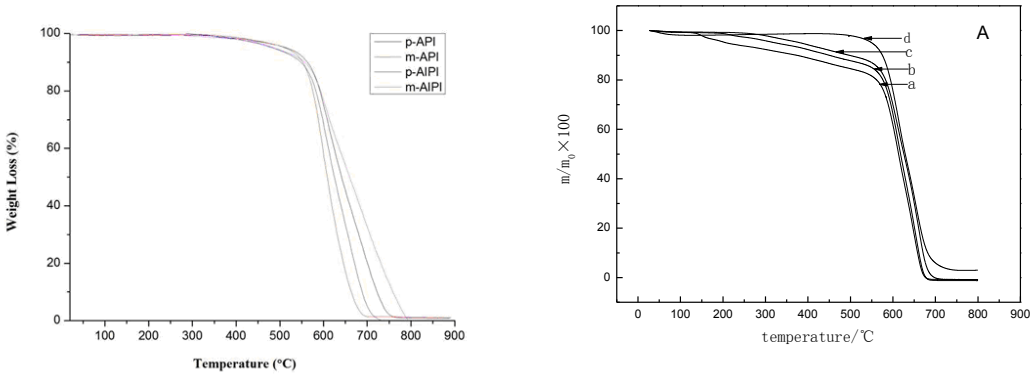


Figure1. The TGA curves of acetylene and phenylethynyl-terminated oligomers
(left：acetylene；right：phenylethynyl)

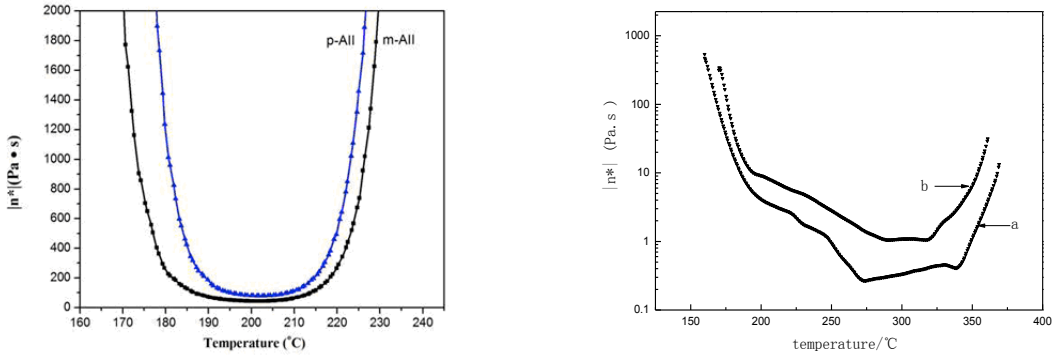


Figure 2. The melt viscosity of oligomers
(left：acetylene；right：phenylethynyl)

Table 1. The minium melt viscosity of phenylethynyl-terminated oligomers in different treatment temperature

Temperature（□）	η_{min}/PII（Pa.s）	η_{min}/PI（Pa.s）
90	0.65	1.49
110	0.29	1.07
150	0.32	0.58
180	0.17	0.59

The authors express their thanks to the National 973 Project of China (No. 2010CB631100) and the National Science Foundation of China (No. 51173178) for their financial supports.