

## Morphology and Mechanical Properties of BPDA/PMDA—ODA Polyimide

### Copolymer Fibers with Different Draw Ratios

Qiong Zhang<sup>a</sup>, Chun-Ling Zhang<sup>a</sup>, Xue-Peng Qiu<sup>b\*</sup>, Lian-Xun Gao<sup>b</sup>, Li-ping Zhang<sup>c</sup>

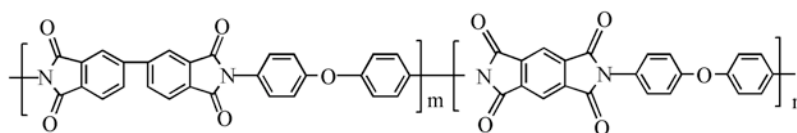
<sup>a</sup>. College of Materials Science and Engineering, Jilin University, Changchun, 130022, PR China

<sup>b</sup>. Polymer Composite Engineering Laboratory, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, China

<sup>c</sup>. Changchun Institute of optics, fine mechanics and physics, Chinese Academy of Sciences, Changchun 130033, China

Email: xp\_q@ciac.jl.cn

In this study, BPDA/PMDA—ODA polyimide copolymer fibers were prepared through dry-jet wet-spinning process. The PAA solution was first prepared from 4,4-oxydianiline (ODA), pyromellitic dianhydride (PMDA), and biphenyltetracarboxylic dianhydride (BPDA). A dry-jet wet-spinning technique was then used to produce the PAA fibers. PI fibers with different draw ratios were then synthesized via thermal imidization and drawing of the as-spun PAA fibers. The chemical structure of the PI copolymer is shown in Figure 1.



PI

Figure 1. Chemical structure of BPDA/PMDA-ODA copolymers.

Figure 2 shows the SEM images of PI fibers with different draw ratios (DR = 1, 1.5, 2.5, and 3.5). The undrawn PI fiber (i.e., DR = 1) has a diameter of 25.8  $\mu\text{m}$ ; when the draw ratios are 1.5, 2.5, and 3.5, the fiber diameters are 21.7, 17.9, and 16.9  $\mu\text{m}$ , respectively. It means increasing the draw ratios results in thinner fibers.

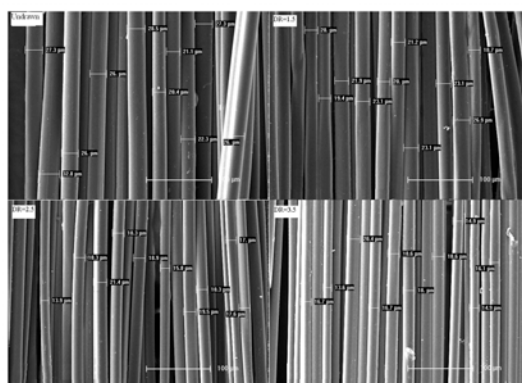


Figure 2. SEM images of PI fibers with different draw ratios (DR=1, 1.5, 2.5, 3.5).

The thermal stability of fibers with different draw ratios are studied with TGA. The fiber with DR = 2.25 exhibits excellent thermal stability, with a residual percentage of 51.6% at 800  $^{\circ}\text{C}$ . The residual percentages of all samples fall in the range of 29% to 52% at 800  $^{\circ}\text{C}$ . These results indicate as-prepared PI fibers possess excellent thermal stability.

The variations in the mechanical properties, including the tensile strength, the tensile modulus, and the elongation at break, are plotted in Figure 3. The maximum value of tensile strength and tensile modulus at break is 6.33Gpa, 88.29Gpa, respectively. The tensile strength exhibits a gradual increase with draw ratio. Meanwhile, Figure 3b exhibits the nearly linear increase in the tensile modulus with draw ratio.

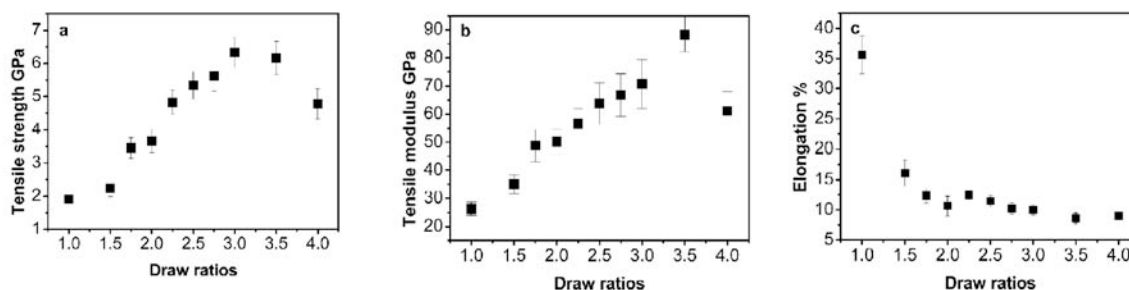


Figure 3 Variation of mechanical properties of PI fibers with draw ratio, (a) tensile strength, (b) tensile modulus, (c) elongation at break.

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