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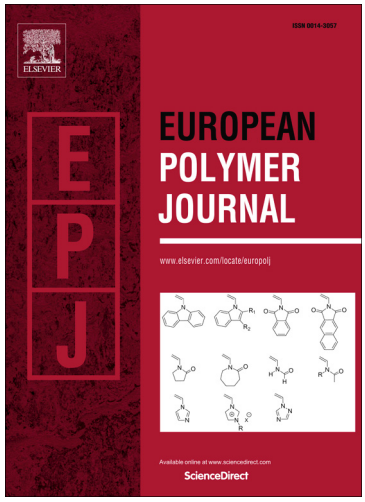

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High Elasticity and Corresponding Microstructure Origin of Novel Long Chain Poly(amide-block-ether) Filament Fibers

Lili Wang[1,2], Xia Dong[1,2*], Ping Zhu[1,2], Xiuqin Zhang[3], Xinran Liu[1,2], Dujin Wang[1,2]

1. Beijing National Laboratory for Molecular Sciences, CAS Key Laboratory of Engineering Plastics, Institute of Chemistry, Chinese Academy of Sciences, Beijing, 100190, China
2. University of Chinese Academy of Sciences, Beijing, 100049, China
3. School of Materials Science & Engineering, Beijing Institute of Fashion Technology, Beijing, 100029, China

Abstract A new kind of elastic filament fibers based on long chain poly(amide-block-ether) (LPAE) was successfully prepared by simple melt spinning. The LPAE elastomer was synthesized with hard blocks of long chain polyamide (LCPA) oligomers, produced by bio-fermenting monomers, and poly(tetra-methylene ether) glycol (PTMEG) soft blocks. The mechanical and thermal results demonstrated that it represented large elongation at break, low initial modulus and excellent elastic recovery, which were comparable to that of commercially used spandex within strain of 200% and superior to that of olefin-based XLA fibers. The high elasticity and reversibility arise from that the LCPA hard segments, representing semi-crystalline state at ambient temperature and generating three dimensional hydrogen bonds between adjacent chains, serve as the physical crossing linking sites, while the polyether soft segments can be deformed largely due to amorphous state and the easy conformation changes of polymer chains. However, beyond 200%, the recovery gradually drops and it origins from the strain-induced crystallization and slight crystal transition in soft and hard segments, respectively. Hence, the novel elastic filament fibers retain the merits of the segmented copolymer and LCPA like better dimensional stability, chemical and abrasion resistance, and better soft handle. With this research, LPAE elastic fiber, featuring excellent elasticity and reversibility, is confirmed to be a promising candidate to replace spandex and XLA fibers in some typical textile applications.

Keywords: Long chain poly(amide-block-ether); Elastic filament fibers; High elasticity; Mechanism