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The influence of polyethylene glycol molecular weight on the crystallization and hydrophilic behavior of poly (ethylene terephthalate)/ polyethylene glycol copolymers

Peng Ji, Chaosheng Wang and **Huaping Wang**
Donghua University, China

As a relatively recently commercialized aromatic polyester has attracted much interest from both industry and academia since its commercialization. This is attributed to that as an engineering thermoplastic, it combines the excellent mechanical properties of poly (ethylene terephthalate) (PET) and the processing characteristics. Although PET fibers materials have been the most widely used chemical fiber materials, it lacks of hydrophilic properties, such as moisture, water adsorption capacity and wetting behavior, leading the decrease of comfort. The copolymerization method that introduction of adsorbed groups or hydrophilic chains into PET chains to prepare copolymers is one of the most important way to afford the moisture adsorption capacity. Poly (ethylene terephthalate)/ polyethylene glycol copolymers (PETG) with various molecule weight of polyethylene glycol ranging from 200 to 8000 g/mol were synthesized by melt polycondensation. Nuclear magnetic resonance spectra of copolymers confirmed the prepared copolymers are the target product. The nonisothermal crystallization kinetics of the PETG copolymers is analyzed using Avrami, Ozawa and Mo methods. The results suggest that only the Mo method is satisfactory in describing the nonisothermal crystallization kinetics of all PETG copolymers at all temperatures and all cooling rates selected. The hydrophilic properties of PETG copolymers and fibers were measured by surface contact angle and water adsorption capacity. Based on these results, a model of the influence of PEG molecular weight on the nonisothermal crystallization and hydrophilic behavior of PETG copolymers is proposed. With the increase of PEG molecular weight, the average sequence length of PET increased and the PET segment is restricted weakly, and then rigid segment and soft segment formes their own crystalline structure. PEG chains with high molecular weight functioned as the nucleating agent of nonisothermal crystallization process and improved the chain mobility of PET segment, and then more water can be adsorbed into PETG copolymers.

Biography

Peng Ji has received his PhD degree in Donghua University in 2016. Then he joined in Donghua University as a Lecturer. From 2011 to 2016 he took part in a continuous academic project that involved postgraduate and doctoral study in the same college of Donghua University. He focuses on poly(ethylene-2,5-furanoate), poly (trimethylene terephthalate) and other biopolymer materials including preparation and characterization of structure and properties..

jipeng@dhu.edu.cn

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