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Effect of PA6 addition on the mechanical properties of PMMA blends

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Abstract. This article studies the mechanical properties of PA6 reinforced polymer blends comprised of a soft PMMA matrix. These composites are designed as a model system to investigate the impact of the content of the two phases on the composite mechanical properties. The addition of the PA6 phase to the matrix PMMA increases the strength of the blend, but lowers its toughness as it decreases the elongation at break. When PA6 particles are added the blends become relatively brittle. The composites containing moderate content of PA6 particles show enhanced tensile modulus and strength. This enhancement is associated with the formation of a network within the polymeric matrix comprised of PA6 particles welded together by the minor component.

Introduction

Compatibilization of blends of PMMA and polyamide 6 (PA6) is necessary in order to produce materials with good final characteristics. Many different compatibilizers that proved useful for blends of PMMA with PA6 have been described in the scientific and patent literature [1,2].

Polyamide-6 (PA6) has been classified as a major engineering thermoplastic material with excellent properties such as solvent resistance, easy processability and good mechanical characteristics. However, some defects such as very high sensitivity to notch propagation under impact test, high moisture sorption, poor dimensional stability and low heat distortion temperature restricted its applications. Much research and blending work has been done to modify its properties [3,4]. PA6 is a semicrystalline polymer, which has two stable crystal forms. In the a crystal form, the hydrogen bonds are formed in the zigzag planes and between the antiparallel chains. The hydrogen-bonded molecules are stacked upon one another forming planar sheets.

Polymethyl methacrylate (PMMA) is one of the most commonly used thermoplastic polymers. PMMA has several desirable properties, including exceptional optical clarity, biocompatibility, good weatherability, high strength, and excellent dimensional stability. It can also be processed at the micro and nanoscale by lithography (deep UV and electron beam) and replication technologies (injection moulding, hot embossing) and has applications in microoptical and microfluidic devices [5,6].

The purpose of this work was to study the mechanical recycled of polyamide industrial waste with blending PMMA. Blending PMMA matrix and recycled PA6 as dispersed phase were prepared.

Experimental

Materials

The dispersed thermoplastic phase is polyamide-6 (Akulon K222D, DSM), denoted here as PA6. Its melting point is 220 ℃ and it has a tensile modulus of 2 GPa at 25 ℃.

Methyl methacrylate (MMA, Guangzhou Chemical Factory, China) was washed with dilute alkali solution and distilled water, dried over calcium chloride and distilled under reduced pressure.