

Impact of precipitation parameters of terephthalic acid on its crystallographic properties

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Abstract:

Polyethylene terephthalate (PET) is one of the most used polymers worldwide, and particularly in textile industry, in which it has a share of 57%_w of the market. Recycling the materials produced for years without thinking about their end of life constitutes a major challenge, and particularly in textile industry, where less than 1% of waste textiles are recycled, notably due to complex compositions [1].

Alkaline hydrolysis enables the recycling of PET / cotton fabrics, resulting in nearly undegraded cellulose and, after acidification of the filtrate, terephthalic acid (TPA) and ethylene glycol. TPA requires further treatments, notably deprotonation and re-precipitation, to achieve the desired properties in terms of purity, granulometry, and morphology to ensure repolymerization into PET. As morphology can depend on the crystalline structure, the influence of precipitation parameters on it should be investigated. It has been shown that TPA crystals can exhibit either a triclinic I form (most commonly), a triclinic II form, or a monoclinic form [2, 3]. More recently, several articles have speculated about obtaining a triclinic II form during precipitation, but none have proved it and linked it to precipitation parameters [4]. In the present study, we examine the influence of precipitation parameters on the crystallographic properties of TPA.

Wide-Angle X-ray Scattering experiments are carried out to determine the structure and are confronted to Differential Scanning Calorimetry results. Scanning Electron Microscopy is also used to investigate differences in crystal morphology. These results are then linked to the precipitation process to emphasize the influence of each parameter on the crystallographic properties. Future work will focus on how the crystallographic structure influences the ability of TPA to be used for downstream operations, such as polymerization into PET.

References:

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