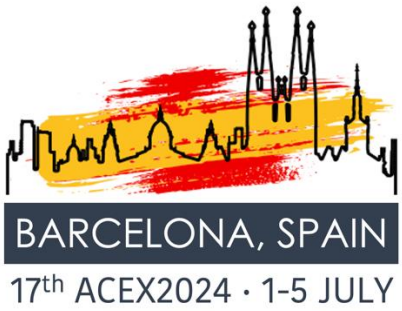

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ABSTRACT:

Multiscale Framework for Estimation of Elastic Properties of PET from Crytallization Temperature

A multi-scale numerical strategy is presented, which allows generating a representative elementary volume (REV) with a spherulitic microstructure used to predict the elastic properties of PET using a 2-scale numerical homogenization scheme. Because of the rapid crystallization kinetics of PET, DSC and optical microscopy were combined with empirical laws to estimate the crystallization kinetic parameters used to generate the REVs. Our framework allows estimating the elastic properties identified by tensile tests for several specimens crystallized at different temperatures. In addition, the comparison with mean-field models from the literature confirms that the Young's modulus of PET does not only depend on the crystallinity volume ratio but also on the crystal organization in the spherulites. The main advantage of this study is to provide a strategy for estimating the elastic properties that can be transposed to many semi-crystalline polymers with a spherulitic microstructure. Nevertheless, this numerical framework is limited for the moment to semicrystalline polymers with a spherulitic microstructure, which crystallize under isothermal condition.