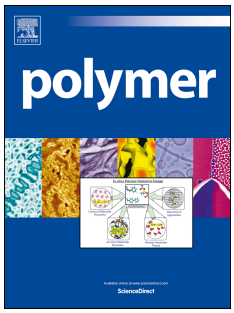

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PII: S0032-3861(17)30665-1

DOI: 10.1016/j.polymer.2017.07.006

Reference: JPOL 19818

To appear in: *Polymer*

Received Date: 14 March 2017

Revised Date: 10 June 2017

Accepted Date: 1 July 2017

Please cite this article as: Shi Y, Zheng C, Ren M, Tang Y, Liu L-Z, He B, Evaluation of principal residual stress and its relationship with crystal orientation and mechanical properties of polypropylene films, *Polymer* (2017), doi: 10.1016/j.polymer.2017.07.006.

Evaluation of Principal Residual Stress and its Relationship with Crystal Orientation and Mechanical Properties of Polypropylene Films

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Abstract

Evaluation of principal residual stress with X-Ray diffraction for metals has been widely practiced, but not for polymers due to a large fraction of amorphous phase, though it is very important for many engineering applications. Such a method is established for rigid semicrystalline polymer with rubber amorphous which, in the present work, are defined as the polymers with an amorphous rubber phase and a crystal matrix (rigid crystal network) providing its plastic modulus. An equal strain model between crystal and amorphous phases and the Young's modulus contributed by both crystal and amorphous phases, instead of moduli from crystal region, are justified for the stress evaluation for rigid semicrystalline polymers. The principal residual stresses obtained with our approach show a very good correlation with crystal orientation and the anisotropic mechanical properties of the polymer films studied. The established method can be widely used for rigid semicrystalline polymers with rubbery amorphous.