

Studies of rheological and structural effects by shear induced crystallization of iPP (structure deve...)

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Summary

The influence of defined simple shear history on the crystallization of an isotactic polypropylene (iPP) in isothermal conditions was investigated. The research of the molten state flow, depending on temperature, shear rate and shear strain, was performed by means of a rheological technique. A flow curve at 144°C, showing a Newtonian region, as well as a shear thinning zone was established by continuous shearing. For a shearing above a critical value, the recovery of the molecular orientation doesn't take place, what provides a kinetic promotion of the crystallization process. An increase of the flow sensitivity parameter, k_s/k_Q , with increasing shear rate at constant strain ($\gamma=150$), was observed during the rheological step-shear flow analysis.

The structure of the iPP samples crystallized during quiescent, steady shear and step-shear experiments was investigated by means of DSC and WAXS measurements. In agreement with the DSC, the WAXS measurements show that predominantly small crystals, with a certain bi-modal distribution, are generated in the step-sheared crystallized samples. A low orientation of the (110) plane of the iPP α -phase crystals was also detected as a result of the shear induced crystallization.

KEYWORDS: isotactic polypropylene, isothermal crystallization, shear-flow, rheology, crystal size.