P-5-1115

A DUAL-SCALE MODELING AND SIMULATION OF STRETCHED ISOTACTIC POLYPROPYLENE FILMS

Ying-Guo ZHOU*, Feng-Jian SHI, Guang-Long WANG

School of Materials Science and Engineering, Jiangsu University of Science and Technology, Zhenjiang, Jiangsu, 212003, P. R. China

**Correspondence to: Ying-Guo Zhou (Tel: +86-13505289063, Email:zhouyingguo@gmail.com)*

Compared with the shear flow of polymer, stretching flow is much more effective in inducing chain extension and orientation. As a result, it is natural that the morphology and modification of crystal can be changed. However, unlike the shear flow, the study of stretching flow relatively lacked because the experimental control of stretch remained more difficult. In this study, the isotactic Polypropylene (iPP) sheet was extruded through a slit die, in which the extruding rate was set small enough to eliminate the shear stress in the die as much as possible. Simultaneously, the extruded sheets were stretched with different drawing ratio (DR) under isothermal and non-isothermal condition. The dual-scale, the dimensional variance at macro-scale and the morphological evolution of crystallization at micro-scale, of the stretched film were then investigated. Experimental result shows that direct result of the increasing DR is the thinning of the sheets, and in return, higher cooling rate occurs. With the drawing ratio increased, the spherulites become smaller and smaller, and the fiber (shish) crystal come out, which indicates that the stretch is favorable to the occurrence of the fiber (shish) crystal. Numerical simulation was further used to interpret the stretch flow field and mathematic modeling of the distribution of the temperature field, the varion of the dimension and morphological evolution of crystallization in stretching flow field was proposed. The predicted result of the dimensional variance at different DR and morphological evolution of crystallization of the film casting is in fairly good agreement with the experimental value.