Processing Optimization and Physical Properties in Dynamic Injection-molded Isotactic Polypropylene

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ABSTRACT

The aim of this paper was to use Taguchi method to optimize the process parameters of dynamic injection molding and explore the relationship between processing conditions and the physical properties of isotactic polypropylene. The morphology and crystallization were also investigated. Both conventional and dynamic injection molding have been employed for the production of moldings. Four process parameters, including vibration frequency, vibration amplitude, injection velocity and packing pressure, were studied based on L9 orthogonal arrays. An increase about 40% in impact strength has been achieved with dynamic injection molding as well as an increase in tensile strength. The results of Taguchi analysis show that vibration frequency and vibration amplitude have greater influences on mechanical properties of isotactic polypropylene than packing pressure and injection velocity in most conditions of our designed dynamic injection molding experiments. The frequency about 10 Hz was found that could improve samples' impact strength pronouncedly. Optimum sets of processing parameters were achieved and testified based on Taguchi method. DSC reveals that dynamic injection molding samples possesses a higher melting point temperature and greater overall crystallinity than moldings produced by conventional methods. WAXD shows finer crystal grains in dynamic injection samples. All these results of morphology and crystallinity are consistent with improved mechanical properties in preceding tests.

Keywords: dynamic injection molding, isotactic polypropylene, Taguchi method, mechanical properties and crystallization

Materials Processing for Properties and Performance (MP^3) Vol. 3
Edited by K.A. Khor, R. V. Ramanujan, C. P. Ooi and J. H. Zhao
Institute of Materials East Asia, 2004