

## **Superior Tough Polymers : Recent Advances in Polymer Processing**

**Hiroshi Ito<sup>a,\*</sup>, Akira Ishigami<sup>a</sup>, Ryosuke Tamamura<sup>a</sup>,  
Paritat Muanchan<sup>a</sup>, Takashi Kurose<sup>a</sup>**

*<sup>a</sup>Research Center for GREEN Materials and Advanced Processing (GMAP),  
Graduate School of Organic Materials Science, Yamagata University,  
Yonezawa, Yamagata, 992-8510, Japan*

\*E-mail: [ihiroshi@yz.yamagata-u.ac.jp](mailto:ihiroshi@yz.yamagata-u.ac.jp)

**Keywords:** Mechanical Properties; Toughness; Polymer Blend; Injection Molding.

The mechanical properties of polymers, particularly in term of toughness, has been intensively and extensively developed for many decades. Thermoplastic elastomer (TPE) represents a versatile material of block copolymers that provide the ductility of rubbers, the strength of plastics, and the processability of thermoplastics. The similar concept of TPE has been implemented commercially for materials development of polymer blends or the new types of polymer blend TPE. Recently, various polymer blending technologies are extremely explored in order to optimize the mixing performance and suitable method for different polymer blend material systems. However, the mechanical properties of TPE molded products are also relatively depended on the thermal history experienced during structural development in the injection molding process. Consequently, this presentation highlights to introduce the progress in advanced polymer processing technology for developing the toughness of polymers. It is divided into two parts: the first section is purposed to present the capability of novel advanced melt mixing processes on the toughening improvement of polyamide6 (PA6) with low-molecular-weight polyethylene (LMPE) or with novel soft materials as polyrotaxane (PR). These novel melt mixing processes consist of the octa screws kneading extruder with the length/diameter (L/D) of 45 and high shear process machine with the maximum rotational speed up to 3,000 rpm. The second part of this presentation will be intended to clarify the influence of thermal history on the mechanical properties and structural development of thermoplastic polyester-based elastomer (TPC) molded parts. Especially these mechanical properties under high-speed deformation on these newly developed tough polymers were analyzed.