OP-10-1000

Thursday, May 12, 2011, 11:30-11:50 am
Room: Karam 2

TOUGHENING AND ANTI-AGEING BY THE EVOLUTION OF NEGATIVE PRESSURE IN POLYMER ALLOYS

S. Nishitsuji*, S. Suzuki, K. Hashima and T. Inoue

Department of Polymer Science and Engineering, Yamagata University,

Yonezawa 992-8510, Japan

**Corresponding author: nishitsuji@yz.yamagata-u.ac.jp*

Poly(lactic acid)(PLA) is a thermoplastic aliphatic polyester derived from renewable resources, such as corn starch and sugarcanes. It is highly interested as a green polymer; however, it has many drawbacks: poor mechanical properties (Izod impact strength=3kJ/m2, elongation at break=3%), low heat resistance (HDT?60℃), and poor processability. By reactive blending of PLA with poly(ethylene-co-glycidyl methacrylate) together with hydrogenated styrene-butadiene-styrene block copolymer (SEBS) and polycarbonate, we successfully developed a super-tough alloy: high Izod impact strength (=63kJ/m2) and elongation at break (=91%). The alloy is not suffered from high temperature annealing (e.g., at 80℃ for 48h); i.e., no serious deterioration of the mechanical properties. DMA analysis showed that the dynamic loss (tan ?) peak for Tg of EB (ethylene-co-butylene block of SEBS) at around -40°C shifts to lower temperature (-50℃) in the alloy. The Tg depression suggests the negative pressure imposed on the dispersed rubber (SEBS) phase, resulting from differential contraction due to the thermal shrinkage mismatch upon cooling from liquid state. The ?–relaxation temperature (T?), at which local segmental motion starts up, was observed at around -80℃ for neat PL A. The T? shifted to lower temperature (around -120℃) in the alloy. The T? depression cor responds to a higher chain mobility of PLA matrix that should lead to the higher toughness and ductility. It may result from a dilational effect for the matrix ligament between the particles: caused by the negative pressure in the dispersed rubber particles. Model experiments on a simple binary system, PC/SEBS, nicely verified the negative pressure effects on the toughening and the anti-ageing.