

## Copolymers of Epsilon-Caprolactam Received via Anionic Polymerization in the Presence of Polypropylene Glycol Based Polymeric Activators

**Authors :** Krasimira N. Zhilkova, Mariya K. Kyulavska, Roza P. Mateva

**Abstract :** The anionic polymerization of  $\epsilon$ -caprolactam (CL) with bifunctional activators has been extensively studied as an effective and beneficial method of improving chemical and impact resistances, elasticity and other mechanical properties of polyamide (PA6). In presence of activators or macroactivators (MAs) also called polymeric activators (PACs) the anionic polymerization of lactams proceeds rapidly at a temperature range of 130-180°C, well below the melting point of PA-6 (220°C) permitting thus the direct manufacturing of copolymer product together with desired modifications of polyamide properties. Copolymers of PA6 with an elastic polypropylene glycol (PPG) middle block into main chain were successfully synthesized via activated anionic ring opening polymerization (ROP) of CL. Using novel PACs based on PPG polyols (with different molecular weight) the anionic ROP of CL was realized and investigated in the presence of a basic initiator sodium salt of CL (NaCL). The PACs were synthesized as N-carbamoyllactam derivatives of hydroxyl terminated PPG functionalized with isophorone diisocyanate [IPh, 5-Isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane] and blocked then with CL units via an addition reaction. The block copolymers were analyzed and proved with <sup>1</sup>H-NMR and FT-IR spectroscopy. The influence of the CL/PACs ratio in feed, the length of the PPG segments and polymerization conditions on the kinetics of anionic ROP, on average molecular weight, and on the structure of the obtained block copolymers were investigated. The structure and phase behaviour of the copolymers were explored with differential scanning calorimetry, wide-angle X-ray diffraction, thermogravimetric analysis and dynamic mechanical thermal analysis. The crystallinity dependence of PPG content incorporated into copolymers main backbone was estimated. Additionally, the mechanical properties of the obtained copolymers were studied by notched impact test. From the performed investigation in this study could be concluded that using PPG based PACs at the chosen ROP conditions leads to obtaining well-defined PA6-b-PPG-b-PA6 copolymers with improved impact resistance.

**Keywords :** anionic ring opening polymerization, caprolactam, polyamide copolymers, polypropylene glycol

**Conference Title :** ICPC 2015 : International Conference on Polymers and Composites

**Conference Location :** Madrid, Spain

**Conference Dates :** March 26-27, 2015