SL 8.21

Structure Development in PA12 Tube Extrusion Influence on Mechanical Properties

<u>A. Carin</u> (a), J.-M. Haudin (a), M. Vincent (a), B. Monasse (a), G. Bellet (b) and N. Amouroux (b) (a) Ecole des Mines de Paris, Centre de Mise en Forme des Matériaux, UMR CNRS 7635, BP 207, 06940 Sophia Antipolis, France (b) Arkema, Cerdato, 27470 Serquigny, France

In PA12 tube extrusion, calibration - or sizing - is the key step that affects subsequent properties. In external calibration, the extruded tube is pulled through a cylindrical calibrator located in a spray tank under vacuum. A water flow rate is applied at the calibrator inner side creating a lubricant water layer at the polymer outer surface. Influence of calibration is twofold. Since it combines a quenching and a mechanical drawing of the tube external surface, high molecular orientation is generated in this zone. Simultaneously, the surface state of the tube can be affected by local catching to the calibrator surface. On-line video recording and lubricating water layer thickness measurements have been carried out to monitor the lubrication dependence of the polymer drawing kinematics. We have shown quantitatively that increasing the water layer thickness leads to a diminution of the draw ratio in calibrator, Dr_{CAL} (ratio between line velocity and velocity at the calibrator entrance). Lubrication and surface state have been correlated through microtopography. Tube molecular orientation has been found between tube superficial orientation and Dr_{CAL} : a reduced elongation of the polymer in the calibrator leads to less superficial orientation. Besides, elongation at break has been found to strongly depend on the molecular orientation resulting from calibration. Thus, surface state, microstructure and tensile properties can be controlled by fitting the calibrator parameters to improve lubrication and reduce the draw ratio in calibrator.