



Correlation between mechanical properties and orientation of the crystalline and mesomorphic phases in isotactic polypropylene fibers		Experiment number: SC-3211
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Report:

The microstructure and mechanical properties of melt-spun isotactic polypropylene (iPP) fibers were studied for different take-up velocities and throughputs with a combination of small- and wide-angle Xray scattering, calorimetry and tensile tests. With the increase of take-up velocity the mesomorphic fraction of the fibers steadily decreases while the crystalline fraction increases. The addition of an alphanucleating agent led to an increase of crystallinity and a slight decrease of the orientation factor. By contrast, a beta-nucleator resulted in a complete suppression of the fiber crystallinity. The orientation factor of the mesophase and/or crystalline phase is found to have a one-to-one correlation with the fiber tenacity and deformation at break. At the same time, the absolute values of crystallinity and/or mesomorphicity are fully uncorrelated with these mechanical characteristics. The observed correlations can be used for example to design and control the fiber mechanical properties by tuning the processing conditions such as take-up velocity, throughput and addition of nucleating agents.

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