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Effect of Processing on Tensile Properties of α - and β -Polypropylenes

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This work directs attention towards specific effects of mould temperature and holding pressure on the tensile properties of neat and β -nucleated isotactic polypropylenes. A commercial-grade of isotactic polypropylene was modified with a β -specific nucleator in the concentration of 0.03 wt.%. From both original (α -iPP) and β -nucleated (β -iPP) materials dog-bone shaped test specimens were injection-moulded using two sets of processing parameters. In the T-set the mould temperature was varied within a range of 40-120 °C by 10 °C steps, while in the P-set the holding pressure was changed from 5.0 to 13.0 MPa in 1.0 MPa steps. Stress-strain measurements performed at room temperature revealed a positive influence of rising mould temperature but negligible effect of holding pressure on elastic modulus of injection-moulded specimens. The softening effect of β -form was manifested by systematically lower values of yield stress of β -iPP as compared to α -iPP. Yield strain of both α - and β -iPP decreased with the structure perfection, i.e. with the increase of mould temperature and the decrease of holding pressure. Outstanding drawability of β -iPP was represented by strain at break, as its values several folds exceeded those of α -iPP. Prolonged solidification times at higher mould temperatures negatively influenced the strain at break of specimens because the formation of larger spherulites was supported. Stress at break of β -iPP decreased correspondingly to strain at break reflecting the positive effect of cold drawing on strength while the increase of transformation ratio in α -iPP resulted in the decrease of stress at break.