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Comparison Study on Crystal Structure and Crystalline Orientation Behaviours of Cold Drawn and Transversely Compressed Metallocene Poly(ethylene-*co*-1-octene) Filaments

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A basic study on the crystal structure and crystalline orientation behaviour of cold drawn and cold compressed metallocene-catalyzed ethylene-octene copolymer with different octene content and different initial orientations was described. All polymers were first melt spun under different draw-down ratios and subsequently received drawing and compression at room temperature, separately. The crystal structures were characterized by wide angle x-ray diffraction (WAXD). For as-spun filaments, an orthorhombic unit cell was found in all polymers, but an extra peak was found for the polymers with the highest octene level (mEO38) and assigned to pseudo-hexagonal form. For cold drawn filaments, several reflection peaks were found for the polyethylene without octene (zEO00) and assigned to a monoclinic unit cell. For one with higher octene levels (mEO15), only one reflection peaks was found and assigned to monoclinic. For the rest materials with even higher octene levels (mEO20, mEO30 and mEO38), an extra peak was observed and assigned to pseudo-hexagonal form. For filaments subject to high lateral pressure in a compression press, similar phenomena were observed. Several reflection peaks from a monoclinic unit cell were found for linear polyethylene and only one reflection peak was found in the copolymer with higher octene level (mEO15). For samples with even higher octene levels, the additional reflection peak was assigned to pseudo-hexagonal form. Orientation factors for the *a*, *b* and *c* axes of orthorhombic crystal of cold drawn filaments were also determined. With increasing cold draw ratio, the *c* axis orientation factors approaches ca.0.9, which the *a* and *b* axis orientation factors decrease to ca.-0.4. For cold compressed filaments, the (110) and (200) of orthorhombic unit cell, the (010) of monoclinic unit cell and the (100) of pseudohexagonal form were aligned along the filament direction.