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Hierarchical Polymorphism of Semicrystalline Polymers. New Insights Through Combined SAXS/ WAXS/ DSC Results on EVA - Poly(ethylene-co-vinyl acetate).

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A new thermo-structural picture of EVA, poly(ethylene-co-vinyl acetate), has been developed by combination of T-scanning SAXS (PDDF analysis), WAXS and DSC results. This expands and supersedes previous, widely accepted 'lamellar' models. The basic element is a 'fringed micelle' with crystalline PE-rich core and amorphous VA-rich matrix. The chain packing in the core features a temperature-dependent chevron or zig-zag structure, with VA as hinge between PE chains, and a spring-like expansion upon heating that accounts for the strong T-dependent changes in the SAXS long spacing. Before melting to liquid, the PE crystalline chain packing mutates from orthorhombic to hexagonal. Most remarkably, the crystalline core 'particles' have similar dimensions in all EVAs of different co-monomer composition studied (9, 16, 28 % VA). At still larger scale, high-resolution SAXS shows that the crystalline domains are embedded in a space-filling 3D cubic lattice of different dimensions, depending on co-monomer composition. This thermo-structural model opens new aspects for, among others, the rational design of EVA-based drug carriers.

Abstract Title

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