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**Insights provided by the build-up, structure and morphology of polymer single crystals**

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Polymer single crystals have been essential in the discovery and widespread acceptance of the concept of chain folding and have been investigated in their own right for decades. Their impact on polymer science is however much wider, since they are essential tools for the analysis of growth mechanisms, of small scale (crystal structure) and large scale (morphology) levels of organization. Several illustrative examples are given. Single crystals have been used recently to determine the impact of secondary nucleation and extent of lateral spread in polymer crystal growth. They are invaluable in the elucidation of mechanically unstable crystal structures of polymers and biopolymers (frequently in combination with epitaxial crystallization). They help reveal otherwise out of reach details of the molecular arrangement or rearrangement in crystal structures: structural disorder, impact of chain folding on crystal structure symmetry, mechanisms of crystal-crystal transformation, etc. The lamellar shape often reveals the impact of chain folds, which can explain the three-dimensional architecture of spherulites produced in the bulk.