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Rheological Characterization of Flow-Induced Crystallization in Extensional and Shear Flows: Implications for Polymer Foaming

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The crystallization behavior of semi-crystalline polymers under flow conditions plays a crucial role in determining foam morphology and properties. While strain hardening is often highlighted as the primary factor enabling high-volume expansion at elevated foaming temperatures, the influence of flow-induced crystallization in both shear and extensional flows—contributing to cell nucleation and stabilization, respectively—remains overlooked. To bridge this gap, rheological characterization is employed to investigate how crystallization kinetics are affected by flow conditions relevant to foaming. By examining the interplay between shear and extensional flows, this study aims to decouple their respective contributions to crystallization dynamics. A deeper understanding of flow-induced crystallization is essential for optimizing processing conditions, improving foam expansion, and refining polymer formulations for enhanced performance. These insights contribute to the broader understanding of polymer processing and foaming, emphasizing the need to consider crystallization kinetics under realistic deformation conditions.