Polydisperse linear polymers: from rheology to flow induced crystallisation

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Abstract:
We discuss a model for the non-linear rheology of polydisperse linear, entangled polymers, the “Rolie-Double-Poly” model, which can be used to predict shear and extensional rheology on the basis of the molecular weight distribution. Further, we discuss how this can be coupled to models predicting flow-induced crystallisation. Here it is anticipated that stretched molecules will lower the energy barrier towards nucleation. However, in a polydisperse material, different molecules are stretched to different degrees, and the central question is which molecules from the distribution are found predominantly in a critical nucleus. We present an analytical solution to this problem, based on the Graham-Olmsted Monte-Carlo model for flow induced crystallisation: the result is sufficiently simple to be included in complex flow calculations.