

Chain-length, flexibility, and the glass transition of polymers

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TU/e, Gem-Z 4.24
October 29, 2019, 11:00-12:00

Abstract

The glass transition is a long-standing unsolved problem in materials science, and our understanding of how a material evolves from a fluid to an out-of-equilibrium solid glass is particularly poor for polymers. I will present an experimental and computational study of how the glass transition temperature T_g and the related structural relaxations vary with molecular weight M and chain flexibility for polymers of varying chemistries. We find a distinctive quasi-universal scaling relation for the functional dependence of T_g on M , controlled by a single chemistry-dependent parameter.

We find logarithmic dependences of T_g and the activation enthalpies for secondary relaxations, and propose that this can be understood in terms of models of dynamic facilitation.