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Influence of Intermolecular Interactions on Fragility of Polymers

KUMAR KUNAL, ALEXEI SOKOLOV, The University of Akron — Glass transition in polymers is a result of slowing down of segmental relaxation. Steepness of the temperature-dependence of segmental relaxation times close to the glass transition temperature, T_g is expressed in terms of fragility parameter. A strongly non-Arrhenius temperature dependence of segmental relaxation times with steep variations close to T_g is called a ‘fragile’ behavior, and a nearly Arrhenius behavior is called ‘strong’. The existing theoretical models and experimental investigations on polymers with weak van der Waal’s interactions suggest that fragile behavior of polymers may be linked to their poor packing ability. However, the effect of strong intermolecular interactions on fragility such as polar interactions and hydrogen bonds remains unexplored. It has been predicted that polymers composed of polar monomers are likely to be highly fragile. We have studied polymers with strongly polar interactions and hydrogen bonds and found that although polar polymers do seem to have a higher T_g than their non-polar counterparts, no such conclusion can be drawn about their fragility. The different effects of polar interactions on different classes of polymers may be attributed to the difference in their T_g s.

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