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Disorder-driven glass transition of polymers ALESSIO ZACCONE, EUGENE TERENTJEV, Cavendish Laboratory, University of Cambridge, UNIVERSITY OF CAMBRIDGE TEAM — The mechanical response of solids depends on temperature because the way atoms and molecules respond collectively to deformation is affected at various levels by thermal motion. This is a fundamental problem of solid state science and plays a crucial role in materials science. In glasses the vanishing of shear rigidity upon increasing temperature is the reverse process of the glass transition. It remains poorly understood due to the disorder leading to nontrivial (nonaffine) components in the atomic displacements. Our theory explains the basic mechanism of the melting transition of amorphous (disordered) solids in terms of the lattice energy lost to this nonaffine motion, compared to which thermal vibrations turn out to play only a negligible role. The theory is in good agreement with classic data on melting of amorphous polymers (for which no alternative theory can be found in the literature) and offers new opportunities in materials science. Ref: A. Zaccone & E.M. Terentjev, Phys. Rev. Lett. 110, 178002 (2013).

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