Abstract Submitted
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The Packing and Jamming of Real Polymer Chains[1] GI XUE, CHAO TENG, Nanjing University — Jamming make a hope to unifying theme for granular materials, glasses and threshold behavior in materials. Here we experimentally prepared a real polymer (polystyrene, PS) with various packing density which was described by inter-segment distances ($\boldsymbol{r}$) detected by NMR. We cold-pressed PS powder at 20 °C (with shearing) and then released the pressure. We found that a transparent pellet with high modulus was formed. PS is usually manufactured by a hot-melting process at 180 °C. The rigidity and transparency of our cold-pressed pellet and its accuracy of the form are testimony that the PS powder once flowed under cold compression to take the shape of its container. This shear-induced melting is exactly what is expected within the jamming picture. By measuring r and the applied pressure σ under which the polymer chain starts to flow, we drew a schematic jamming phase diagram. The σ-$\boldsymbol{r}$ curve for a real polymer is convex at $\boldsymbol{r}$ < 0.5 nm, while it becomes concave as r is larger than 1 nm. It is the van der Waals attraction that acts as a confining pressure on segments, and makes the σ-$\boldsymbol{r}$ curve convex on the very short scales.

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