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Ameba-like diffusion in two-dimensional polymer melts: how critical exponents determine the structural relaxation TORSTEN KREER, HENDRIK MEYER, JOERG BASCHNAGEL, Institut Charles Sadron, 6 rue Boussingault, 67083 Strasbourg, France — By means of numerical investigations we demonstrate that the structural relaxation of linear polymers in two dimensional (space-filling) melts is characterized by ameba-like diffusion, where the chains relax via frictional dissipation at their interfacial contact lines. The perimeter length of the contact line determines a new length scale, which does not exist in three dimensions. We show how this length scale follows from the critical exponents, which hence characterize not only the static but also the dynamic properties of the melt. Our data is in agreement with recent theoretical predictions, concerning the time-dependence of single-monomer mean-square displacements and the scaling of concomitant relaxation times with the degree of polymerization. For the latter we demonstrate a density crossover-scaling as an additional test for ameba-like relaxation. We compare our results to the conceptually different Rouse model, which predicts numerically close exponents. Our data can clearly rule out the classical picture as the relevant relaxation mechanism in two-dimensional polymer melts.

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