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Solvent-polymer thin films drying below Tg DIDIER LONG, GREGOIRE JULIEN, ELIAN MASNADA, CNRS/Solvay — We propose a model for describing the dynamics of polymer-solvents systems close to the glass transition. We extend to these systems the facilitation mechanism due to free volume diffusion proposed by Merabia and Long (EPJ E 2002; J. Chem. Phys. 2006, Chen et al 2009) to the case of polymer-solvent systems. Our model is solved on a 2D lattice with a spatial resolution corresponding to the scale of dynamical heterogeneities. It allows to describe how a solvent penetrates a glassy film (case II diffusion, Kramer et al 1988). Regarding the process of film drying, we show that films up to a few hundred of nm thick can be almost completely dried in an accessible experimental time scale, even at temperatures 100 K below the glass transition temperature of the pure polymer as shown experimentally by Catherine Allain and co-workers (2002, 2003). The thinner the films, the shorter the drying time, allowing to obtain far from equilibrium polymer films a few tens of nanometer thick in a state very different from bulk glassy polymers. For thicker films, a glassy crust a few hundred of nanometers thick appear and the subsequent evaporation of solvent slows down progressively over very long time scales.

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