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Spreading dynamics of a water droplet on a soluble polymer: glass transition effects EMILIE VERNEUIL, JULIEN DUPAS, PPMD-SIMM, CNRS, UPMC, ESPCI ParisTech -Paris, France, MARCO RAMAIOLI, LAURENT FORNY, Nestlé Research Center, Lausanne - Switzerland, LAURENCE TALINI, FRANCOIS LEQUEUX, PPMD-SIMM, CNRS, UPMC, ESPCI ParisTech - Paris, France — We study the wetting dynamics of a droplet of solvent spreading on a soluble polymer coating. The complexity arises from the transfers of solvent and of soluble material through 3 processes: liquid evaporation and recondensation on the substrate, diffusion of the liquid in the substrate from the droplet, and substrate dissolution within the droplet. Indeed, when completely dry, the substrate, although soluble, is initially poorly wetting. Hydration enhances the wettability of the coating and the contact angle is found to decrease at higher humidity or at lower spreading velocity. In this paper, we explore experimentally the situation where hydration itself induces a sharp change in the diffusion coefficient of water in the polymer: this is what happens when the polymer undergoes a glass transition in water content. Diffusion coefficient changes by orders of magnitude upon glass transition, and we show that it results in a sharp effect on the course of the spreading as the hydration will be affected by the change in diffusion in the coating. We validate the previously derived model describing the various spreading regimes observed, and we expand it to account for the glass transition effects. It also successfully describes the results we obtain with other solvents and substrates.

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