Hole formation in crystalline thin films

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Polymer thin films made by spin-casting play an important role in many applications, especially in their use to modify the surface chemistry of a bulk material. As such, it is very important to understand their stability in detail, as it greatly affects the eventual surface properties. This work investigated a metastable system, which behaves like a stable film under some conditions and like an unstable film under others. It specifically examined the effect of thermal annealing on these films, with the goal of elucidating changes in morphology as the films approached their thermodynamically stable states. This occurs through a process called dewetting. Poly(vinyl alcohol) thin films were spin-cast onto a polydimethylsiloxane substrate. Poly(vinyl alcohol) is a semicrystalline polar polymer, which means its dewetting behavior is different from that of nonpolar polymers, on which most of the studies in this area have been done. Initial dewetting resembled what is seen in the literature for nonpolar systems. Advanced dewetting showed unique fractal morphologies. Under some conditions, annealing did increase the extent of dewetting and lead to the formation of new holes in the thin films.