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Capillary levelling of a liquid stepped film supported on an immiscible liquid film (G)*

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Thin polymeric films have numerous technological applications and their stability has garnered intense interest. The stability and flow of a thin, viscous film is sensitive to the boundary conditions as the film thickness approaches the nanoscale. Here we probe a liquid-liquid boundary condition: a stepped polymer film is placed above a different, immiscible polymer film. The ensemble is supported by a solid substrate. The temporal evolution of the air-polymer interface, as well as the polymer-polymer interface were studied using atomic force microscopy. The polymer-polymer interface was exposed by using a selective solvent to remove the top film. Experimental results show that the step at the air-polymer interface levels off to minimize the excess surface area, and that there is substantial deformation at the interface between the two polymers during the levelling process. These findings are discussed in light of a developed lubrication model.

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