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Morphology and Growth Dynamics of Buckling Polymer Surfaces

DEREK BREID, Dept. of Polymer Science and Engineering - University of Massachusetts, ALFRED CROSBY, Dept. of Polymer Science and Engineering, University of Massachusetts — Surface buckling is an expected response of a polymer surface when an applied in-plane stress exceeds a material-defined critical stress. This onset of a prescribed surface struture has been gaining increasing attention over the last decade towards applications as diverse as enhanced adhesion and flexible circuitry. However, the majority of research has been performed for systems subjected to stresses well above their critical buckling stress. Here, we highlight recent experiments that characterize the buckle morphology and dynamic buckling behavior of an oxidized PDMS surface swollen with solvent vapor. At low stresses, we observe the spontaneous formation of hexagonally packed microlens arrays not predicted by current buckling theory. These structures coalesce at higher stresses into predicted morphologies. This understanding provides new routes for the controlled formation of surface patterns with complex arrangements and geometries.

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