Structural Change in Buckling Depending on the Directional Mechanical Heterogeneity of Top Thin Films

권도경, 윤현식[1], 서효선[2], 차국헌†
서울대학교; [1]서울과학기술대학교; [2]University of Chicago
(khchar@plaza.snu.ac.kr†)

Buckling of thin films placed on elastomeric substrates is the well-known phenomenon in buckling instability originating from the moduli mismatch between a substrate and a thin film placed on top. Recently, many studies on the microstructures created by the buckling with flat top films have been reported and the physics behind them has been well understood. However, almost none has been done for the buckling structure with micropatterned top films and the buckling mechanics for patterned top film-PDMS (polydimethylsiloxane) bilayers thus has not yet been studied in detail. Here, we present the buckling of mechanically heterogeneous, patterned top films placed on top of elastomeric substrates. Mechanically heterogeneous top films were prepared by polystyrene (PS) films with topographic patterns. Buckling instability was induced by applying mechanical stresses to the PS-PDMS bilayers. Resulting buckling structure showed the structural change depending on the alignment of the top films with respect to the buckling direction. The hierarchical structural change was modeled using a beam theory, showing good agreement with experimental results obtained.