

Society of Engineering Science 51st Annual Technical Meeting

1–3 October 2014

Purdue University, West Lafayette, Indiana, USA

Unique wrinkling behavior of stiff thin films on shape memory polymers

Xiao, Jianliang, jianliang.xiao@colorado.edu, University of Colorado Boulder, United States

ABSTRACT

Shape memory polymers (SMPs) can remember two or more distinct shapes, and therefore can have many applications. We here presents combined experimental and theoretical studies on the wrinkling of stiff thin films on SMPs. Experimental results show well-defined, wavy profiles of the thin films. Time and temperature dependent wrinkle formation and evolution were observed. It was shown that both wrinkling wavelength and amplitude increase with SMP relaxation. This is different from earlier observations of thin film wrinkling on soft substrates, which show decreasing wavelength and increasing amplitude when compression increases. Finite element simulations accounting for the thermomechanical behavior of SMPs were used to study wrinkling of thin films on SMPs, which show good agreement with experiments. This study can have important implications in surface engineering, stretchable electronics, and advanced manufacturing.