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Folding of thin film on a highly pre-strained elastomer ATSUSHI TAKEI, HIROYUKI FUJITA, University of Tokyo — Multi-layered systems composed of a rigid thin film and an elastomeric base are ubiquitous in Nature and technology. When the rigid thin film is deposited on the stretched elastomeric base, periodical patterns appear on its surface in releasing the pre-strain. If the pre-strain is small ($\sim 10\%$), sinusoidal wavy patterns appear entirely on the surface as known in literature. On the other hand, with the large pre-strain ($\sim 50\%$), the deformation is localized, and foldings are engendered. We studied this phenomenon experimentally using a balloon structure composed of a PDMS chamber and a thin organic membrane Parylene. Firstly the chamber is filled with oil and inflated like a balloon. Then, keeping its pressure, the organic membrane is deposited on the surface. By changing the pressure inside the chamber during the deposition, the pre-strain can be ranged over 50%. In this study, we demonstrate the pre-strain dependency on the morphology in one dimensional and two dimensional models. We also present that with the balloon structure the surface roughness can be tuned by changing the pressure and that it can be applied to a tunable hydrophobic surface.

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