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Influence of Molecular Weight and Processing Conditions on the Thermal Stability of Nanoimprinted Polymer Structures YIFU DING, HYUNWOOK DING, KYLE ALVINE, BRIAN OKERBERG, National Institute of Standards and Technology, JING ZHOU, JACK DOUGLAS, ALAMGIR KARIM, CHRISTOPHER SOLES, National Institute of Standards and Technology — We study the influence of both molecular weight of a polymer resist and the nanoimprint process conditions on the thermal stability of the patterned polymer structures. Specifically, we measure the decay rate of the imprinted polymer patterns during thermal annealing by combining diffraction/reflection of X-ray/light and AFM. As a result, highly entangled polymers are found to contain large amount of residual stresses introduced by the imprinting process, which dominates the pattern decay during the annealing. Levels of the residual stresses can be controlled by the imprinting conditions. On the contrast, unentangled polymers behavior like a Newtonian liquid with no sign of residual stress resulted from the patterning process. Furthermore, we also observe correlated lateral pattern instability during the annealing, in addition to the vertical pattern decay. This lateral instability is greatly enhanced when the surfactants were added during the imprint process. Implications of these findings on the nanoimprint fabrication processes will be discussed.

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