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Visualization and minimization of clustering of micro-pillars and walls due to liquid film evaporation[1] TAE-HONG KIM, JUNGCHUL KIM, HO-YOUNG KIM, Seoul National University — The spin drying, in which a rinsing liquid deposited on a wafer is rapidly dried by wafer spinning, is an essential step in the semiconductor manufacturing process. While the liquid evaporates, its meniscus straddles neighboring submicron-size patterns such as pillars and walls. Then the capillary effects that pull the patterns together may lead to direct contact of the patterns, which is often referred to as pattern leaning. This poses a problem becoming more and more serious as the pattern size shrinks and the aspect ratio of the patterns increases. While the clustering behavior of high-aspect-ratio micro- and nanopillars was investigated before, a technical strategy to prevent such clustering has been pursed in industrial practices without being supported by the recently established theory of elastocapillarity. Here we visualize the clustering behavior of polymer micropatterns with the evaporation of liquid film while varying the sizes and temperature of the micropatterns. We find a critical role of substrate temperature in preventing the leaning of the patterns via changing the evaporation rate and behavior of the liquid film. Also, we construct a regime map that guides us to find a process condition to avoid pattern leaning in semiconductor manufacturing.

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Ho-Young Kim
Seoul National University

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