Rapid in-plane pattern growth for large-scale inverse replication through secondary electrohydrodynamic instability

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Nanopatterning using secondary electrohydrodynamic (EHD) instability of polymer films offers an opportunity for resolving the drawbacks inherent in the conventional imprinting or other molding methods because EHD force not only requires no physical contact but also is easily tuned. Nonetheless, its technical potential has been easily overlooked due to the limited size of negative replica (several to tens of micrometers). In this work, we first propose a new route for large-area patterning through high-speed evolution of negative replica growth along the in-plane axis. By accelerating the in-plane growth while selectively controlling a specific edge growth, the replica area is extended from micro- to centimeter scale with high-fidelity. Further, even in non-uniform contact mode, this rapid in-plane growth mode enables uniform large-scale replication, which is not allowed in the conventional imprinting or other molding methods.