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Annihilation Kinetics of Dislocation Pairs in Directed Self-Assembly of Block Copolymer Thin Films SU-MI HUR, Chonnam Natl Univ, VIKRAM THAPAR, ABELARDO RAMREZ-HERNNDEZ, PAULINA RINCON DELGADILLO, PAUL NEALEY , JUAN DE PABLO, University of Chicago
— Understanding the mechanism of defect annihilation in block copolymer self-assembly is critical in developing materials and processes leading to target morphologies. The complex interactions between unstable defects in a high defect density drive the ordering formation at the beginning stage of self-assembly. But, the latter stage involves metastable distinguishable defects. Here, our study is focused on understanding the motion of these defects and interactions among them. Previous studies have predicted the minimum free energy path (MFEP) connecting a jog defect (adjacent dislocations with the opposite sign of Burgers vector) to a perfect lamellae, and showed that defect annealing is an activated process. This MFEP shows a kinetic energy barrier only in the order of kT, implying that the system can make a transition to perfect lamellae easily. However, since the attraction between the dislocations decays with distance, two initially separated dislocation pair will interact weakly and the precise route to their annihilation has to be investigated. In this work, we present calculations aiming to understand how such dislocation pairs interact and move toward perfect lamellae both on patterned and unpatterned substrates. We also discuss how pinning on guiding stripes alters the MFEP. Our results further provide an explanation of experimental observations, which show a difference in the frequency of encountering dislocation pairs depending on the relative position to the guiding stripes.

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