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Effect of hexagonal patterned arrays and defect geometry on the critical current of superconducting films IVAN SADOVSKYY, YONGLEI WANG, ZHILI XIAO, WAI-KWONG KWOK, ANDREAS GLATZ, Argonne National Laboratory — Understanding the effect of pinning on the vortex dynamics in superconductors is a key factor towards controlling critical current values. Large-scale simulations of vortex dynamics can provide a rational approach to achieve this goal. Here, we use the time-dependent Ginzburg-Landau equations to study thin superconducting films with artificially created pinning centers arranged periodically in hexagonal lattices. We calculate the critical current density for various geometries of the pinning centers – varying their size, strength, and density. Furthermore, we shed light upon the influence of pattern distortion on the magnetic field dependent critical current. We compare our result directly with available experimental measurements on patterned molybdenum-germanium films, obtaining good agreement. Our results give important systematic insights into the mechanisms of pinning in these artificial pinning landscapes and open a path for tailoring superconducting films with desired critical current behavior.

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