

Rectified vortex motion in an Nb film with a spacing-graded array of holes

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### Abstract

Superconducting Nb thin films with a spacing-graded array of holes were prepared by electron beam lithography. Two films with different hole gradients were fabricated. The ac-driven vortices were investigated in Nb superconductors with a spacing-graded array of holes. The measurements revealed pronounced rectified voltage when the vortex lattice is driven by an ac injected current. The rectified voltage is mainly caused by the strength of the vortex vortex interaction. The rectified motion of a vortex is affected by the pinning potential of the spacing-graded array and the applied magnetic field. The vortex vortex interaction strength changes the effective pinning landscape of the vortices and an asymmetric potential is formed. Vortices depin easily from high concentration to low concentration of pinning sites. In both samples, the ac-driven vortices exhibit a variety of dynamical responses and the rectified voltage is tunable with the applied magnetic field.

Keyword : Superconductor, thin films, scanning electron microscopy, flux pinning