Mode-locking measurements for driven vortices in thick and thin amorphous Mo_xGe_{1-x} Films

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Vortex states in type-II superconductors are largely dependent on the dimensionality of superconductors. For ideal thin superconducting films with no pinning the melting line of vortex lattice is predicted to be nearly independent of field at low field. However, the sharp melting transition as well as the peak in the depinning current vs field curve, the so-called peak effect, has not yet been observed in actual thin films. The results suggest that the vortex lattice for the thin films may be unstable against small pinning. The effects of pinning would be much reduced by simply driving the vortices. Here, we conduct a mode-locking (ML) experiment, which enables us to detect the coherent motion of driven vortices,[1] for weak-pinning a-Mo_xGe_{1-x} films with thickness ranging from 10 to 350 nm. The clear ML resonance indicative of driven vortex lattices is observed for the thick film, while it is not visible for the thin film. The results suggest that for the thin film the elasticity of the driven lattice is significantly reduced and the lattice is unstable against small pinning.

[1]S. Okuma, J. Inoue, and N. Kokubo, Phys. Rev. B **76**, 172503 (2007): S. Okuma, Y. Yamazaki, and K. Kokubo, Phys. Rev. B **80**, 220501(R) (2009).