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Polaronic pinning of vortex in magnetic superconductors and magnetic-superconducting multilayers[1] SHI-ZENG LIN, LEV BULAEVSKII, Los Alamos National Laboratory — We present a new type of vortex pinning by enhancing the viscosity of vortex in magnetic superconductors with long relaxation time of magnetization and large magnetic susceptibility. In the absence of current, vortices are dressed by nonuniform magnetic polarization and form vortex-polarons. Under a small current and consequently low Lorentz force, the magnetic polarization follows the vortex motion. However, at long magnetic relaxation time of magnetization, there is additional dragging force by the magnetization besides the Bardeen-Stephen one, thus the effective viscosity of vortex is significantly enhanced resulting in suppression of dissipation. For a large current, the magnetic polarization cannot follow the vortex motion and the vortex-polaron dissociates, i.e. the magnetization and vortex become decoupled. In the IV characteristic, the decoupling transition shows as a voltage jump and can be identified as a depinning transition. The polaronic pinning mechanism successfully explains the observed enhancement of critical current in the ErNiBC superconductor at low temperatures. The polaronic pinning can be optimized in magnetic-superconducting multilayers. We show also that vortex-polaron creep is suppressed at low temperatures.

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