Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Current-induced phase textures and pairbreaking in multilayered structures and two-gap superconductors. ALEX GUREVICH, University of Wisconsin, Madison, WI, VALERII VINOKUR, Argonne National Laboratory, Argonne, IL — We predict an inhomogeneous state in current-carrying multilayers or superconductors with multicomponent order parameters. Using the GL theory, we show that the current I flowing along a weakly coupled bilayer (with two different superconducting layers) can result in a two-stage pairbreaking process: 1. Current-induced interlayer decoupling due to a transition from the phase-locked state at $I < I_b$ to a periodic chain of interlayer 2π phase slips for $I > I_b$. This phase texture re-distributes currents between the layers, the period of the texture L(I) decreases as I increases similar to the period of the vortex lattice L(H) in a long Josephson junction. 2. The global pairbreaking at the depairing current $I_d >> I_b$. The same current-induced band decoupling and interband phase textures occur in two-gap superconductors with two weakly coupled s-wave order parameters, such as MgB_2.Using the Usadel equations we derive an equation for the interband phase difference valid for all temperatures. This equation shows that at small currents $I < I_b$, the π and σ bands are phase-locked, while for $I > I_b$, the band decoupling transition occurs as an equilibrium interband phase slip structure forms along the direction of current flow. These interband phase textures can manifest themselves in dc transport, vortex properties and nonlinear rf impedance.

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Date submitted: 28 Nov 2005 Electronic form version 1.4