Flux line dynamics in vanadium and niobium films containing square lattices of submicron holes

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Abstract

An interference lithographic technique has been developed to produce large area films of vanadium and niobium containing square lattices (period d=1 μm) of submicron holes (diameter D=0.4 μm). Commensurability effects between the superconducting flux line lattice and the hole lattice are observed when the applied field equals a multiple of the matching field $B_m = \Phi_0/d^2 = 20.7$ G. At these fields DC magnetization, AC susceptibility, magnetoresistivity and I-V measurements reveal peaks in the susceptibility and critical current that depend nonlinearly upon the value of external AC field or current. Various structures of the flux line lattice and their stability are discussed.