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Vortex Image and Superconducting Properties of High T_c Oxide and MgB_2 Thin Films and Junctions

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We present the fabrication of thin films and junctions for high T_c oxide and MgB_2 superconductors and report their transport properties and vortex images. Thin films and junctions are fabricated using a pulsed laser deposition method incorporating photolithography and an Ar ion milling technique. Vortex images are investigated using a scanning SQUID microscope (SSM). For high-T_c YBCO(001) films, quantized vortices with normal isotropic shape are observable , while for YBCO(110) thin films, long vortices of several tens of μm long are observed for the first time, verifying the presence of a long Josephson penetration depth normal to the *c*-axis. For MgB_2 thin films, quantized vortices with normal isotropic shape are again observable and the temperature dependence of penetration depth is given. The SSM images at the ramp-edge junctions provided an interesting information on the superconducting coupling in these junctions. Some result on the transport properties of the MgB_2/Bi2212 mesa-type heterojunctions is also presented and discussed with comparison to YBCO/Bi2212 heterojunctions.

keywords : scanning SQUID microscope, quantized vortex, flux quantum, MgB_2, $YBa_2Cu_3O_{7-y}$, $Bi_2Sr_2CaCu_2O_y$, heterojunction