Patterned irradiation of $YBa_2Cu_3O_{7-x}$ thin films

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We present an experiment on $YBa_2Cu_3O_{7-x}$ thin films using spatially resolved heavy ion irradiation. Structures consisting of a periodic array of strong and weak pinning channels were created with the help of metal masks. The channels formed an angle of $\pm 45°$ with respect to the symmetry axis of the photolithographically patterned structures. Investigations of the anisotropic transport properties of these structures were performed. We found striking resemblance to guided vortex motion as it was observed in $YBa_2Cu_3O_{7-x}$ single crystals containing an array of unidirected twin boundaries. The use of two additional test bridges allowed us to determine in parallel the resistivities of the irradiated and unirradiated parts as well as the respective current-voltage characteristics. These measurements provided the input parameters for a numerical simulation of the potential distribution of the Hall patterning. In contrast to the unidirected twin boundaries in our experiment both strong and weak pinning regions are spatially extended. The interfaces between unirradiated and irradiated regions therefore form a Bose-glass contact. The experimentally observed magnetic field dependence of the transverse voltage vanishes faster than expected from the numerical simulation and we interpret this as a hydrodynamic interaction between a Bose-glass phase and a vortex liquid.