Observation of the Vortices Trapped in Stacking Fault Dislocation in $Bi_2Sr_2CaCu_2O_8$ by Magnetic Force Microscope

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We have studied the vortex structure in $Bi_2Sr_2CaCu_2O_8$ single crystal with low-density artificial columnar defects by using a low temperature magnetic force microscope. We observed that some of the line cleavage steps are acting as strong line pinning centers for magnetic vortices in this material. By comparing with the corresponding topographic image, we confirmed that these line steps are the stacking fault dislocations. Measurements at several different temperatures show that the pinning strength at the observed stacking fault dislocation can be larger than that of artificial columnar defects formed by the irradiation of 1.3 GeV uranium ions. The stacking fault dislocation seems to trap vortices along the plane of the dislocation, thus vortices move freely along the dislocation line.