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Magnetic force microscopy study of a $Ba_{0.55}K_{0.45}Fe_2As_2$ single crystal: Local penetration depth and flux pinning LAN LUAN, OPHIR M. AUSLAENDER, KATHRYN A. MOLER, JAMES G. ANALYTIS, JIUN-HAW CHU, IAN R. FISHER, Stanford University — We use a magnetic force microscope (MFM) to study both the penetration depth (λ_{ab}) and flux pinning in the iron-pnictide superconductor $Ba_{0.55}K_{0.45}Fe_2As_2$ by imaging and manipulating vortices. We observe the same regular signature from all vortices in a $50\mu m$ x $50\mu m$ field of view, implying little or no inhomogeneity of the superfluid density down to the sub-micron scale. Quantitative analysis of images of isolated vortices and of the Meissner repulsion of the magnetic tip from the sample gives the temperature-induced change of λ_{ab} and an estimate for its absolute value. We detect no long-range order in the vortex positions, suggesting the absence of correlated pinning in the material. We measure the force required to depin individual vortices and the force required to drag them across the entire sample. This allows us to characterize the pinning potential in the material and its distribution as well as to set bounds on the local critical current.

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