The Effect of 45° Grain Boundaries and Associated Fe Particles on J_c and Resistivityin $Ba(Fe_{0.9}Co_{0.1})_2As_2$ Thin Films

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Abstract - The anisotropy of the critical current density J_c depends in general on both the properties of the flux lines (such as line tension, coherence length and penetration depth) and the properties of the defects (such as density, shape, orientation etc.). Whereas the J_c anisotropy in microstructurally clean films can be scaled to an effective magnetic field containing the Ginzburg-Landau anisotropy term, it is in general not possible (or only in a limited field range) for samples containing extended defects. Here, the J_c anisotropy of a Co-doped Ba $(Fe_{0.9}Co_{0.1})_2As_2$ sample with 45° [001] tilt grain boundaries (GBs), i.e., grain boundaries created by 45° in-plane rotated grains, as well as extended Fe particles is investigated.

This microstructure leads to *c*-axis correlated pinning, both due to the GBs and the Fe particles and manifests in a *c*-axis peak in the J_c anisotropy at low magnetic fields and a deviation from the anisotropic Ginzburg-Landau scaling at higher fields. Strong pinning at ellipsoidal extended defects, i.e., the Fe particles, is discussed, and the full J_c anisotropy is fitted successfully with the vortex path model. The results are compared to a sample without GBs and Fe particles. 45° GBs seem to be good pinning centers rather than detrimental to current flow.

Keywords - Ba-122, pnictide, thin film, electrical transport, pinning, anisotropy PACS: 74.70.Xa, 74.78.-w, 74.25.Sv, 74.25.F-, 74.25.Wx

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