Electrical transport properties of clean and pinning-improved Co-doped Ba-122 thin films on single-crystal and technical substrates

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High-quality thin films of $Ba(Fe_{0.9}Co_{0.1})_2As_2$ (Ba-122) are deposited by pulsed laser deposition from stoichiometric targets under UHV conditions (base pressure 10^{-9} mbar). At the interface between oxide substrates and the film, a natural and highly coherent Fe interfacial layer of a few nm thickness is often observed. Introducing artificial thin Fe buffer layers, which improve the structural film quality dramatically, we gain more freedom in the type of substrate. Recently, we showed for the first time Ba-122 films on IBAD-MgO covered flexible metal tapes and on piezo-electric PMN-PT.
Angular dependent electrical transport properties ($J_c(T, B, \theta), R(T, B, \theta)$) of Ba-122 films on a variety of substrates are shown and discussed within the framework of Anisotropic Ginzburg-Landau Scaling and Vortex Path Model. The J_c scaling approach on clean films reveals the temperature dependence of the effective-mass anisotropy γ. The contribution of c-axis correlated defects to the J_c anisotropy is analysed with the Vortex Path Model. On IBAD-MgO tapes with an in-plane FWHM of 1.7°, J_c values comparable to films on single-crystal MgO were achieved ($J_c \geq 1$ MA/cm^2 at 4 K, 0 T). J_c is limited by intra-grain pinning rather than the grain boundaries in these films.