Critical currents anisotropy in $REFeAsO_{1-x}F_x$ (RE = Sm, Nd) single crystals

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High values and relatively low anisotropy of the upper critical field of FeAs-based superconductors revived hopes for large scale applications. An important question arises if the pinning properties of these compounds provide satisfactory high and isotropic critical currents at high magnetic fields. We focus on the critical currents and their anisotropy for the $REFeAsO_{1-x}F_x$ single crystals (RE111, RE = Sm, Nd) in high magnetic fields (up to 14 T). The highest magnetically measured $j_c > 10^6$ A/cm^2 ($T \sim 5$ K, $B \sim 14$ T) has been determined for a Sm111 crystal with $T_c \simeq 46$ K, which shows slightly lower $B_{c2}(T)$ if compare to the Sm111 crystals with higher T_c and to the Nd111 crystal. The j_c anisotropy, $\gamma = j_c^{ab}/j_c^c \simeq 2$, is surprisingly low and almost field independent at low temperatures. These results agree well with those obtained by transport measurements.[1] The pinning force for $B \| c$ has been analyzed by a scaling procedure using Dew-Hughes' approach, which clearly shows pinning centres of only one type to be dominant at higher fields and temperatures. Our detailed studies of the superconducting magnetic and transport properties of the RE111 single crystals reveal a promising combination of high and nearly isotropic intragrain critical current densities.

[1]P. J. W. Moll, R. Puzniak, F. Balakirev, K. Rogacki, J. Karpinski, N. D. Zhigadlo, and B. Batlogg, Nature Materials **9**, 628 (2010).