Critical currents and peak effect in $Sm(Nd)FeAsO_{1-x}F_x$ single crystals

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In addition to presenting intriguing physics, the FeAs based superconductors revive our hopes for large scale applications due to their high upper critical fields and relatively low anisotropy. An important question arises if the pinning properties of these compounds are sufficient to provide high critical currents at elevated temperatures. In this work the critical currents for $SmFeAsO_{1-x}F_x$ single crystals with two different F substitution levels and T_c´s equal to about 46 and 51 K are reported, together with results for a $NdFeAsO_{1-x}F_x$ single crystal ($T_c \approx 47$ K) for comparison. The crystals have been characterized by magnetic and transport measurements and the *H-T* phase diagram was constructed. For optimally doped $SmFeAsO_{1-x}F_x$, the persistent critical current density $j_c \sim 3 \times 10^6$ A/cm^2 has been measured in the *ab*-plane at 5 K and in 7 T magnetic field oriented perpendicular to the plane. Clear evidence for an increase of the pinning force with increasing field is seen as a pronounced peak in $j_c(H)$. For temperatures higher than 7 K, the peak in $j_c(H)$ appears in magnetic fields available in our experiments. For example, at 15 K a maximum critical current of 8×10^5 A/cm^2 has been observed at 4 T. Extrapolating the measured peak field to lower temperatures, where it exceeds the range accessible in our measurements, we estimate the peak field to be ≈ 10 T at 2 K. This large value, together with the measured critical currents, is indeed promising for applications.