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Understanding and eliminating the fast creep problem in Fe-based superconductors LEONARDO CIVALE, SERENA ELEY, BORIS MAIOROV, Materials Physics and Applications Division, Los Alamos National Laboratory, Los Alamos, USA, MASASHI MIURA, Graduate School of Science Technology, Seikei University, Tokyo, Japan — One surprising characteristic of Fe-based superconductors is that they exhibit flux creep rates (S) as large as, or larger than, those found in oxide high temperature superconductors (HTS). This very fast vortex dynamics appears to be inconsistent with the estimate of the influence of the thermal fluctuations as quantified by the Ginzburg number (Gi), which measures the ratio of the thermal energy to the condensation energy in an elemental superconducting volume. In particular, compounds of the $A\mathrm{Fe_2As_2}$ family ("122") have $Gi \sim 10^{-5}$ to 10^{-4}, so S could be expected to lie between that of low T_c materials (where typically $Gi \sim 10^{-8}$) and HTS such as $\mathrm{YBa_2Cu_3O_7}$ ($Gi \sim 10^{-2}$), as indeed occurs in other superconductors with intermediate fluctuations, such as $\mathrm{MgB_2}$ ($Gi \sim 10^{-6}$ to 10^{-4}). We have found the solution to this puzzle: the fast creep rates in 122 compounds are due to non-optimized pinning landscapes. Initial evidence comes from our previous studies showing that the introduction of additional disorder by irradiation decreases creep significantly in 122 single crystals, although still remaining well above the ideal limit. We now have new evidence from 122 thin films demonstrating that S can be reduced to the lower limit set by Gi by appropriate engineering of the pinning landscape.

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