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# [Invited] Different nature of flux pinning in Fe-based superconductors

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The Fe-based superconductors (FBS) present a large variety of compounds whose properties, including flux pinning, are affected to different extents by their crystal structures. The doped $AEFe_2As_2$ phases ($AE = Ba, Sr$) mostly show a 3D character similar to low-$T_c$ superconductors and can accept a high density of artificial pinning centers. On the contrary, the $REFeAs(O, F)$ family ($RE1111$, $RE$ rare earth element) has the highest critical temperature $T_c$ (~58 K in bulk form) among FBS and a large upper critical field anisotropy that induce properties more similar to high-$T_c$ superconductors (HTS). Here we investigated the pinning properties of Nd1111 in flux-creep regime.[1] For $H//c$ the critical current density $J_c$ can be described by standard mechanisms such as point/planar defect pinning and vortex shearing. When the field approaches the $ab$-planes two different regimes are observed at low temperatures as a consequence of the transition between 3D-Abrikosov and 2D-Josephson vortices: one is determined by the formation of a vortex staircase structure, which suppresses the $n$-value ($V \sim I^n$ ), the other one by the lock-in of the vortices parallel to the layers, which induces an increase of $n$. This is the first study on FBS showing this behavior in a full temperature, field, and angular range and demonstrates that, despite the relatively low $T_c$ and anisotropy of Nd1111 compared to HTS, this compound is substantially affected by intrinsic pinning similarly to $YBa_2Cu_3O_{7-\delta}$.

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[1] Tarantini et al. Scientific Reports 6, 36047 (2016).

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