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Unconventional pinning in iron based superconductors of 122 family

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Based on our results of critical current measurements and data published by other groups, we report on comparative analysis of vortex pinning in Fe-based superconductors (FBS) of the 122 family with different type of doping within the models proposed by R. Griessen et al [*Phys. Rev. Let.* **72** (1994)] and Dew-Hughes [*Phil. Mag.* **30** (1974) 293]. The first one describes behavior of the temperature dependence of the critical current density in the framework of δT-pinning (fluctuation of the critical temperature, extended pinning centers) and δl-pinning (random deviations of the mean free path charge carriers, point like pinning centers). The second one evaluates the strength of pinning force depending on the position of the peak maximum (h_{peak}) on the curve of normalized pinning force versus reduced field. The location of the $h_{peak} < 0.5$ indicates strong pinning centers, while the position of the $h_{peak} > 0.5$ suggests weak pinning centers. In accordance with Dew-Hughes model, our analysis shows that FBS 122 superconductors with electron and hole-doping demonstrate strong pinning ($h_{peak} \sim 0.3 - 0.45$), whereas isovalent doping (i.e. substitution As for P) shows $h_{peak} \sim 0.7$ indicating weak pinning. We argue that pinning in FBS with isovalent doping can be successfully described by δT and δl models, while pinning in FBS 122 superconductors with electron and hole-doping shows behavior significantly different from the δT or δl model predictions.

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