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Flux Pinning and Critical Current Density in TiO₂-doped MgB₂ SuperconductorJ.-H. Kang¹, J. S. Park², Y. P. Lee^{2*}, and V. G. Prokhorov³¹Department of Nano and Electronics Physics, Kookmin University, Seoul, 136-702 KOREA²q-Psi and Department of Physics, Hanyang University, Seoul, 133-791 KOREA³Institute of Metal Physics, Kiev, 03142 Ukraine

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MgB₂ by doping TiO₂ was synthesized by the in-situ solid state reaction to study the effects of TiO₂ dopant on the flux pinning behavior of MgB₂ superconductor. From the field-cooled and the zero-field-cooled temperature dependencies of magnetization, the realm of vortex-glass and vortex-liquid states of TiO₂-doped MgB₂ were determined in the H-T diagram (the temperature dependence of upper critical magnetic field and irreversibility line). The critical current density was estimated from the width of hysteresis loops in the frame work of Bean model [1] at different temperatures. The obtained results manifest that nano-scale TiO₂ inclusions serve as the effective pinning centers and lead to the enhanced upper critical field and critical current density. It is concluded that the grain - boundary pinning mechanism is realized in TiO₂-doped MgB₂ superconductor.

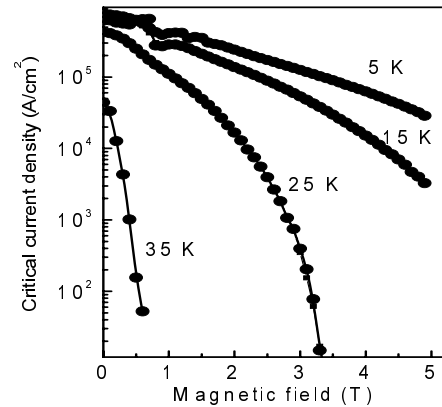


Fig. 1. Critical current density for TiO₂-doped MgB₂ superconductor at different temperatures.

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REFERENCES

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BR04

Gapless behavior in *d*-wave Superconductors Due to Coexisting Antiferromagnetism

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It is well-known that antiferromagnetism and superconductivity in the high-temperature superconductors has an intimate relationship; It is also well-known that the magnetic penetration depth measurement on the electron-doped high-temperature superconductors (e.g., Pr_{2-x}Ce_xCuO_{4-y} and La_{2-x}Ce_xCuO_{4-y}) suggests that the superconductors have a nodeless superconducting order parameter [1], which is in contrast with the case in the hole-doped high-temperature superconductors. In our study, we find that a weak antiferromagnetic order coexisting with a nodal *d*-wave superconducting order can result in a magnetic penetration depth, and also a specific heat measurements that suggest a nodeless superconducting order. Therefore, such measurements do not rule out the possibility of a *d*-wave superconducting order in the electron-doped superconductors.

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REFERENCES

- [1] See, e.g., M. Kim *et al.*, Phys. Rev. Lett. 91, 87001 (2003).