T1-P009

Flux pinning and critical current density in TiO_2-doped MgB_2 superconductor

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MgB_2 doped with TiO_2 was prepared by the in-situ solid state reaction to study the effects of TiO_2 dopant on the flux pinning behavior of MgB_2 superconductor. From the field-cooled and the zero-field-cooled temperature dependences of magnetization, the realms of vortex-glass and vortex-liquid states of TiO_2-doped MgB_2 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 framework of Beam's model at different temperatures. The results indicate that nano-scale TiO_2 inclusions play a role of the effective pinning centers and lead to the enhanced upper critical field and critical current density. It is suggested that the grain-boundary pinning mechanism is realized in TiO_2-doped MgB_2 superconductor.