Influence of the Heat-treatment Temperature on the Critical Properties of $C_4H_6O_5$-doped MgB_2/Fe Wire

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The effects of the heat-treatment temperature on the carbon (C) substitution amount, full width at half maximum (FWHM) value, critical temperature (T_c), critical current density (J_c), irreversibility field (H_{irr}), and upper critical field (H_{c2}) have been investigated for 10 wt % malic acid ($C_4H_6O_5$)-doped MgB_2/Fe wires. All the samples were fabricated by the *in-situ* powder-in-tube (PIT) method and heat-treated within a temperature range of 650 °C to 1000 °C. As the heat-treatment temperature increased, it seemed that the lattice distortion was increased by a more active C substitution into the boron sites from the malic acid addition. These increased electron scattering defects seemed to enhance the J_c-H properties in spite of an improvement in the crystallinity, such as a decrease of the FWHM value and an increase of the T_c. Compared to the un-doped wire heat-treated at 650°C for 30 min, the J_c, H_{c2} and H_{irr} were enhanced by the C doping in a high-field regime. The wire heat-treated at 900 °C resulted in a higher magnetic J_c of approximately 10^4 A/cm^2 at 5 K and 8 T, and it showed the H_{irr} value of 11 T at 20 K from the resistance versus temperature curves.

Keywords : MgB_2 wire, malic acid, critical properties, heat-treatment temperature

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