Electron Microscopy Analysis of the Superconducting Malic Acid Doped MgB2 Wires

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The morphology and chemistry of the malic acid ($C_4H_6O_5$) doped MgB_2 wires have been characterized by FE-SEM and FE-TEM. MgB_2 wires have been fabricated using malic acid as a carbon source through Powder-In-Tube (PIT) process using pure Fe as sheath material and sintering at 650℃~1000℃. The superconducting properties such as T_c and H_{c2} increased as the sintering temperature increased up to 900℃. The grains with sphere shape in the sample are well connected but the sample has a low density. Also, as sintering temperature increases, void size decreased. To investigate the correlation between microstructural features and superconducting properties of the malic acid doped MgB_2 wires with different heat-treatment, TEM and EDS analyses were performed on the specimens were prepared by tripod polishing and ion milling method. The morphology of the malic acid doped MgB_2 appears inhomogeneous, consisting of crystalline grains from several tens of nanometers in size to 500 nm. Impurity particles with the size less than 5nm were embeded in the MgB_2 grain or grain boundaries, but the distribution was not uniform. Nano-sized carbon, MgO layer, and the other second phases have been characterized with HREM, STEM-EDS, and selected area diffraction.

Keywords: MgB_2, Wire, PIT, Malic acid, TEM