**POTENTIAL INVESTIGATIONS ON CORRELATION BETWEEN LOCAL STRUCTURAL AND SUPERCONDUCTING PROPERTIES OF MgB2 SUPERCONDUCTORS**

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Abstract

The effect of non-magnetic and magnetic artificial pinning centers (APCs) on the crystal structure and flux-pinning properties of some type-II superconductors was investigated. Hybrid physicochemical vapor deposition technique was used to fabricate ~400 nm-thick MgB2 films. The irradiation processes of different ions consisting of Sn, Ni, Nb were performed with an energy from 1 MeV and an ion dose ranging from 3E13 ions/cm2 to 9E13 ions/cm2. To prove the possible variation in crystal structure of the MgB2 films, the X-ray diffraction (XRD), X-ray absorption (XAS) and Raman measurements were applied. The XRD results showed that all fabricated MgB2 films were highly c-axis oriented, and the c-axis lattice constant slightly increased with increased the Sn, Ni and Nb-ion doses. The XAS data revealed the extension of 1st nearest neighbor (1NN) Mg–B and 2NN Mg–Mg shells. Raman analyses provided decreased electron–phonon coupling. These results can provide evidence for the formation of point-like defects and lattice disorders caused by Sn, Ni and Nb-ion irradiation. The critical temperature (Tc) determined from the magnetization versus temperature and resistivity versus temperature curves was found to decrease with increased Sn, Ni and Nb-ion dose. For the application purpose, the critical current density (Jc) and upper critical field (Hc2) were investigated. Jc was increased for the Sn, Ni and Nb-irradiated MgB2 films at low ion doses, and the maximum Jc was obtained for the proper using of ion dose. The upper critical field (Hc2) deduced by using two-band Ginzburg–Landau (GL) hypothesis was also found to increase for the ion irradiated MgB2 films. The pinning mechanism was found to shift from normal surface to normal point pinning. A possible reason for these phenomena was the existence of point-like defects created by the Sn, Ni and Nb-ion irradiation. More interestingly, the penetration of vortices into the MgB2 films was observed by using the magnetic force measurement (MFM), which obviously indicated the existent of the obtained point-like defects.

**BIBLIOGRAPHY**

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