Seminar

Institute for Plasma Research

Title : Doping-induced super-lattice-like structure in the isotopic $Mg^{11}B_2$ bulk superconductor for fusion applications (*)

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Date : 23rd March 2017 (Thursday)

Time : 03.30 PM

Venue : Seminar Hall, IPR

Abstract :

Superconducting wires are widely used for fabricating magnetic coils in fusion reactors. Superconducting magnet system represents a key determinant of the thermal efficiency and the construction/operating costs of such a reactor. In consideration of the stability of ^{11}B against fast neutron irradiation and its lower induced radioactivation properties, MgB_2 superconductor with ^{11}B serving as the boron source is an alternative candidate for use in fusion reactors with a severe high neutron flux environment. In the present work, the glycine-doped $Mg^{11}B_2$ bulk superconductor was synthesized from isotopic ^{11}B powder to enhance the high field properties. The observed grains with reduced symmetry and the corresponding peaks of Raman spectra suggested that a super-lattice-like structure was formed, and the lattice-scale TEM image further proved that the macroscopic grains with the super-lattice structure are consisted of two Mg-B layers and one Mg-B-C layer in between. Owing to this unique structure, the transition temperature, which was supposed to decrease due to either isotope effect or carbon doping, remained at the same level as that for the un-doped $Mg^{11}B_2$ sample. Furthermore, the critical current density was enhanced (10^3 $A \cdot cm^{-2}$ at 20 K and 5 T) over the entire field in contrast with the sample prepared from natural boron.

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