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Effect of Nb deficiency on T_C enhancement in NbB_2: ^{11}B and ^{93}Nb NMR investigations

C. S. Lue*[1], and T. H. Su

[1]Department of Physics, National Cheng Kung University, Tainan 70101, Taiwan

*Corresponding author: cslue@mail.ncku.edu.tw, Phone: +886 6 27575752, Fax: +886 6 2747995

Observations of the Nb-deficiency enhanced superconducting temperature (T_c) in NbB_2have been reported. In order to elucidate the possible origins for the phenomenon, we have carried out the nuclear magnetic resonance (NMR) study on the $Nb_{1-x}B_2$ (x = 0, 0.13, 0.20, and 0.26) alloys. From both ^{11}B and ^{93}Nb NMR spin-lattice relaxation rates, we can deduce the B-2*p* and Nb-3*d* partial Fermi-level density of states (DOS) for each individual composition. The results indicate that the B-2*p* and Nb-3*d* partial Fermi-level DOS increase with Nb deficient level. Such a tendency is consistent with the trend of the superconducting temperature, revealing that the observed T_c enhancement is correlated to the increase of the Fermi-level DOS induced by the Nb deficiency.

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Superconductivity of Metal Oxides doped Ceramics

Sang Heon Lee*[1] and Yong Choi[2]

[1]Department of Electronic Engineering, Sun Moon University, Asan, Chung Nam, 336-708, Korea

[2]Department of Electronic Materials Engineering, Sun Moon University, Asan, Chung Nam, 336-708, Korea

*Corresponding author: shlee@sunmoon.ac.kr, Phone: +82 41 530 2357, Fax: +82 41 530 2933

Magnetic flux measurements of a toroidal magnet revealed a concave shaped field distribution with a single minimum value and a null field along the axis of the torus at the point where the field was reversed. The non-linear magnetic field of the toroidal magnet perpendicular to the Ag_2O doped superconducting disk sample with the trapped magnetic flux distorted the field line distribution. As a result, the interaction force between the magnet and sample exhibited regions of repulsive, null, attractive, null,and finally repulsive force. The asymmetrical concave shaped force pattern along the axis with two null force points indicates that the magnetic force exerted form the sample changed direction which resulted in the transition from repulsive force to attractive force at the null force point, and the force becomes repulsive again beyond the second null force point as the distance along the axis increases. The lateral stability of the suspended sample under the toroidal magnet is provided by the characteristics of thesymmetrical nature of the field line with respect to the axis of the magnet. The magnetic moment of an undoped and 2 % Ag_2O doped sample was shown to be m = 0.043 emu and 0.06 emu, respectively. The measured suspension force exerted formthe doped sample agreed well with the suspension force calculated from magnetostatic force distribution. This work was carried out with help of National Research Lab.(NRL) program of Korea Science and Engineering Foundation (KOSEF) and Ministry of Science and Technology, Korean government.

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