



Contribution ID: 12

Type: POSTER

Beta-NMR measurement of Cu-58 in Si

First result of the beta-NMR of ^{58}Cu in Si

Please specify whether you would prefer an oral or poster contribution.

oral contribution

Summary

Contamination of silicon with copper impurities has been a longstanding problem in processing devices, which causes degradation of their performance because of the fast diffusivity and formation of deep levels in the band gap [1]. β -NMR studies with a short lived nucleus ^{58}Cu ($I\pi = 1+$, $T_{1/2} = 3.2$ s) as a microscopic probe should be able to provide unique information on the mechanism of Cu diffusion and behavior of Cu-dopant complex (ex. Cu-B pair) in Si. In this report we present the first result on the β -NMR measurements of ^{58}Cu in silicon. A spin polarized ^{58}Cu beam was produced through the charge exchange reaction of ^{58}Ni with a Be target, using a 63A-MeV ^{58}Ni beam provided by the K540 RIKEN Ring Cyclotron. The ^{58}Cu nuclei emitted at angles in between 0.75° and 4.1° were separated by RIPS and implanted into a catcher sample of single crystalline Si (B doped) at 15 K. The β -ray yield from ^{58}Cu was ~ 103 counts/s. The finite polarization of about 0.2% was observed and then the β -NMR spectrum for ^{58}Cu in Si was obtained as shown in Fig. 1. The magnetic moment of ^{58}Cu was determined to be $(0.46 \pm 0.03)\mu_N$ which is in agreement with the recent results on the laser spectroscopy [2]. The spin lattice relaxation rate $1/T_1 = (0.7 \pm 0.6)$ s $^{-1}$ for ^{58}Cu in Si(B) was also obtained at 15 K. The present result has shown that the ^{58}Cu nucleus is promising as a nuclear probe for the microscopic study of copper impurities in silicon.

Primary author: Dr MIHARA, Mototsugu (Osaka University)

Co-authors: YOSHIMI, Akihiro (RIKEN); OZAWA, Akira (University of Tsukuba); NISHIMURA, Daiki (Osaka University); HORIKAWA, Daisuke (Kochi University of Technology); NAGAE, Daisuke (University of Tsukuba); UENO, Hideki (RIKEN); OISHI, Hiroto (University of Tsukuba); HACHIUMA, Isao (Saitama University); SATO, Kazuhiko (Saitama University); MATSUKAWA, Kazuhito (Renesas Technology Corp.); YAMADA, Kazunari (RIKEN); MATSUTA, Kensaku (Osaka University); NAMIHARA, Kohei (Saitama University); ASAH, Koichiro (Tokyo Institute of Technology); SHIRAI, Koun (ISIR, Osaka University); SUZUKI, Kunifumi (Tokyo Institute of Technology); TAKECHI, Maya (RIKEN); FUKUDA, Mitsunori (Osaka University); MOMOTA, Sadao (Kochi University of Technology); SUZUKI, Shinji (Niigata University); MINAMISONO, Tadanori (Fukui University of Technology); KUBOKI, Takamasa (Saitama University); NAGATOMO, Takashi (International Christian University); OHTSUBO, Takashi (Niigata University); YAMAGUCHI, Takayuki (Saitama University); SUZUKI, Takeshi (Saitama University); IZUMIKAWA, Takuji (Niigata University); MORIGUCHI, Tetsuro (University of Tsukuba); KUBO, Toru (Niigata University); ISHIBASHI, Yoko (University of Tsukuba); HIRAYAMA, Yoshikazu (KEK); KOBAYASHI, Yoshio (RIKEN); ICHIKAWA, Yuichi (RIKEN); NAMIKI, Yuichi (Niigata University); ITO, Yuta (University of Tsukuba)

Presenter: Dr MIHARA, Mototsugu (Osaka University)

Track Classification: Semiconductors, Metals and Insulators