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Disorder-Sensitive Superconductivity and Bonding Network in the Iron-Silicide Superconductor $Lu_2Fe_3Si_5$ TADATAKA WATANABE, HIROAKI OKUYAMA, KOUICHI TAKASE, YOSHIKI TAKANO, Nihon University, FUMIKO YOSHIDA, CHIKAKO MORIYOSHI, YOSHIHIRO KUROIWA, Hiroshima University — Iron silicide superconductor $Lu_2Fe_3Si_5$ exhibits relatively high $T_c = 6.0$ K among Fe-based substances. Recent specific heat, penetration depth, and thermal conductivity measurements have provided evidences for the multigap superconductivity. We have studied non-magnetic and magnetic impurity effects on superconductivity in $Lu_2Fe_3Si_5$ by investigating T_c variations in non-magnetic $(Lu_{1-x}Sc_x)_2Fe_3Si_5$, $(Lu_{1-x}Y_x)_2Fe_3Si_5$ and magnetic $(Lu_{1-x}Dy_x)_2Fe_3Si_5$. Small amount of non-magnetic impurities (Sc and Y) on the Lu-site rapidly depresses T_c in accordance with the increase in the residual resistivity. Such a disorder-sensitive superconductivity strongly suggests the sign reversal of the superconducting order parameter. $Lu_2Fe_3Si_5$ has a complicated crystal structure compared to other multigap superconductors such as MgB_2 and iron pnictides. Thus it is important to map out the accurate bonding network in the crystal structure for the better understanding of the electronic structure. We have observed the charge density distribution of $Lu_2Fe_3Si_5$ by analyzing the synchrotron radiation powder diffraction data using the maximum entropy method/Rietveld method.

Tadataka Watanabe
Department of Physics, College of Scinece and Technology, Nihon University

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