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Effect of controlled point like disorder on low-energy quasiparticle excitations in $CeCu_2Si_2$ TAKAAKI TAKENAKA, YUTA MIZUKAMI, University of Tokyo, MARCIN KONCZYKOWSKI, Ecole Polytechnique, SILVIA SEIRO, HIRALE S JEEVAN, CHRISTOPH GEIBEL, Max Planck Institute, JOE A WILCOX, CARSTEN PUTZKE, ANTONY CARRINGTON, University of Bristol, YOSHIFUMI TOKIWA, YUJI MATSUDA, Kyoto University, TAKASADA SHIBAUCHI, University of Tokyo — $CeCu_2Si_2$ is a prototypical heavy-fermion superconductor found in 1979 with $T_c \sim 0.6$ K. The gap structure of $CeCu_2Si_2$, which is a direct consequence of the pairing mechanism, is believed as line nodal d-wave type. However, recent low-temperature specific heat, thermal conductivity and penetration depth measurement in single crystals of $CeCu_2Si_2$ demonstrate the absence of gap nodes at the any point on the Fermi surface. Such a fully gapped state may still have a sign change of gap function between separated Fermi surfaces. To test this $s_\pm$ state, we focus on the impurity effect on the low-energy quasiparticle excitations. If the sign-reversing state is realized, mid-gap states due to the interband scattering is created around the Fermi level with increasing disorder and extra low-energy excitation appears. On contrary to this, in the sign-preserving state, no mid-gap state is formed by disorder. To introduce impurity scattering by homogeneous point defect, we employ 2.5 MeV electron irradiation. Here, we report on systematic measurements of penetration depth λ in $CeCu_2Si_2$ with increasing the point defect, from which we will discuss the gap symmetry in this system.

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