Type-I superconductivity in Ga-II phase of elemental Gallium

Rustem Khasanov*, Joel Verezhak, Hubertus Luetkens, Elvezio Morenzoni, and Alex Amato

[1]*Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland*

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*e-mail: rustem.khasanov@psi.ch

The pressure induced superconductivity in Ga-II phase of elemental Gallium (the transition temperature T_c~6.45 K) was studied experimentally by means of muon-spin rotation. Experiments reveal that Ga-II is the type-I superconductor with the zero temperature thermodynamic critical field $B_c(0)$=64.07(1) mT. The analysis of $B_c(T)$ data within the phenomenological α-model, ref [1], allows to estimate T_c=6.448(2) K, Δ=1.121(1) meV, and the coupling strengths $2\Delta/k_BT_c$= 4.024(2) (Δ is the zero-temperature value of the superconducitng energy gap).

Correlation between the thermodynamical critical field B_c and the transition temperature T_c (see Fig.1) and between the coupling strengths $2\Delta/k_BT_c$ and $B_c/T_c\gamma$ ($\gamma$is the normal-state Sommerfeld specific heat coefficient) for various single metal superconductors and binary alloys were obtained. Both these correlations are well explained considering the phonon-mediated BCS type superconductivity and suggest, therefore, the similar type of the superconducting mechanism for Ga-II phase of elemental Gallium.

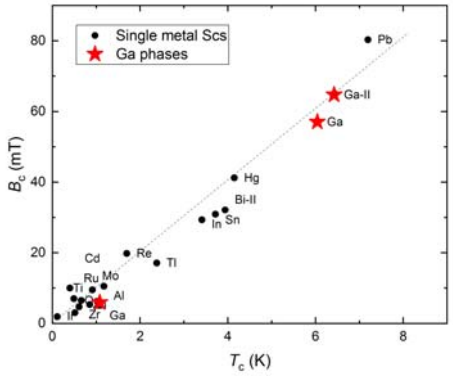

Figure 1. Correlation between the thermodynamical critical field B_c and the rnasition temperature T_c in single-element superconductors (after [2]). The various Ga phases are denoted by red starts.

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[2] J.W. Rohlf, *Modern physics from α to Z*, Williey (1994).