

# Stress and volume effects on cubic and axial superconductors

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# STRESS AND VOLUME EFFECTS ON CUBIC AND AXIAL SUPERCONDUCTORS

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Summary

On single crystals of cubic (lead and aluminium) and axial (indium, tin, zinc and gallium) metals we have measured the length changes at the magnetic field induced transition from the superconducting to the normal state between 0.3 K and the appropriate critical temperature $T_c$. The measurements were made with a capacitive dilatometer and it was possible to detect relative length changes of the order of $2 \cdot 10^{-10}$.

The pressure and volume dependence of the critical field $H_c$ at T = 0 K and $T = T_c$ and of the critical temperature $T_c$ were obtained from the temperature dependence of the length changes. By measuring these length changes on crystals with different orientations it was possible to obtain information on the anisotropy of the pressure dependence of the superconducting parameters. For indium, zinc and gallium we observe different signs for the length changes in different directions.

From an approximation of the BCS theory which is also valid in the strong coupling region it follows that the similarity principle may be violated for strong and medium coupled superconductors. For lead we find direct experimental evidence for this behaviour while for indium and tin the effect is too small to be seen in the experiment.

Using the well known Rutgers formula we have deduced the volume dependence of the electronic specific heat $\gamma$. From an explicit expression for the critical temperature $T_c$ due to Mc Millan we obtained the influence of different deformations on the electron-phonon interaction parameter $\lambda$ from experiment. This can be compared with values which are derived from a theoretical expression for $\lambda$, considering the volume dependence of the appropriate pseudopotential. From the knowledge of $\partial \ln\gamma / \partial \ln V$ and $\partial \ln\lambda / \partial \ln V$ it is then possible to make an estimate of the volume dependence of the electronic density of states N(0) at the Fermi level. This quantity shows considerable anisotropies in the case of axial metals.