

Low-temperature (to 15 K) conductivity of the compound Nb-H

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Our purpose was to investigate the influence of hydrogen on the superconductivity of niobium.

The investigations were performed on deformed ($\epsilon = 99\%$) foils 0.03 mm thick, electrolytically saturated with hydrogen. The initial material contained 99.99% Nb. The hydrogen concentration was determined with a chromatograph.

It follows from the experimental results (see Fig. 1) that the Nb-H compound becomes superconducting at hydrogen concentrations 0.2-34 at. % (H/Nb = 0.002 - 0.52). The superconductivity vanishes above 34 at. % H.

A characteristic feature is that the critical temperature in the indicated interval of compositions is 9.3K and does not depend on the hydrogen concentration in the niobium.

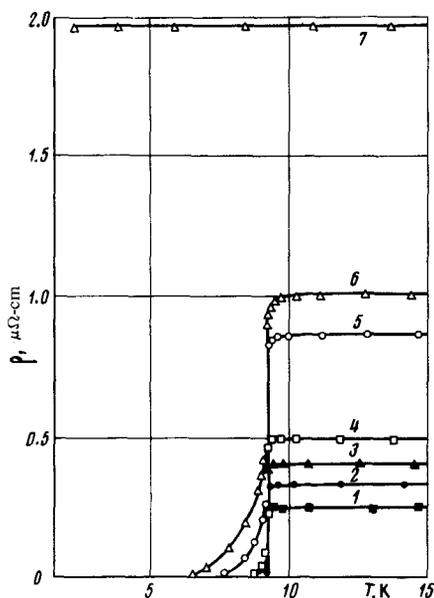


FIG. 1. Dependence of the resistivity ρ on the temperature T : 1—Nb, 2— $\text{NbH}_{0.028}$, 3— $\text{NbH}_{0.065}$, 4— $\text{NbH}_{0.228}$, 5— $\text{NbH}_{0.42}$, 6— $\text{NbH}_{0.511}$, 7— $\text{NbH}_{0.64}$.

In essence, almost all the investigated compounds pertain presumably (the phase composition of the Nb-H system has hardly been investigated at temperatures below 70 K) to the two-phase $\alpha + \beta$ region^{1,2} which includes a solid solution of hydrogen in niobium (α) and niobium hydride (β). The existence of a superconducting transition from NbH 0.002, which presumably is a single-phase compound (α phase), seems to indicate that the superconductivity in the investigated compounds is due to the α -solid solution of hydrogen in niobium.

In conclusion, it should be noted that the prevalent point of view^{3,4} that T_c decreases with increasing hydrogen concentration in the niobium is not confirmed in this case.

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