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SUPERCONDUCTIVITY OF NIOBIUM AT HIGH PRESSURE

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The influence of all-round pressure on the transition temperature T_c of Nb is investigated up to pressures of about $25 \cdot 10^3$ kg/cm^2. T_c traverses a flat minimum at about $5 \cdot 10^3$ kg/cm^2 and rises steeply at higher pressures. The average slope of this increase is $3.5 \cdot 10^{-5}$ °K cm^2/kg between 10^4 kg/cm^2 and $2 \cdot 10^4$ kg/cm^2.

1. INTRODUCTION

Many new findings have been reported in recent years /1/ on the effect of mechanical stresses, especially all-round pressure, on the transition temperature T_c and the critical field H_c of superconductors. A distinct difference was found between the transition metals and the nontransition metals in the region of moderate pressures, as has been pointed out by Andres, Olsen, and Rohrer /2/. With the exception of Tl, the classic superconductors, which belong to the group of nontransition metals, exhibit a rather uniform, monotonic fall of T_c with rising pressure. The transition metals, on the other hand, exhibit a very much smaller pressure effect, which varies greatly, moreover, from one metal to another.

As substantial deviations from the behavior of the blassic superconductors had also been observed in the isotope effect in the transition metals, it might have been assumed that the two phenomena manifested a fundamental difference between transition and nontransition metals.

To check this conjecture it seems to be necessary to extend the investigations to higher pressures, especially for the transition metals. The example of Tl, whose transition temperature passes through a flat minimum at moderate pressures (approx. 1000 kg/cm^2), clearly shows that observations covering a broader pressure range are needed to establish the presence of any fundamental differences with any certainty.

The present research was carried out with this in mind. The first substance chosen was niobium, as no direct observations of the transition temperature under pressure are known. Only the initial rise of the T_c (p) function could be plotted from measurements of thermal expension below T_c /3/. It leads us to expect only a very slight lowering of the transition temperature of niobium as the pressure is raised. Information on the further course of the pressure function of T_c could be obtained only from observations made under pressure.