SUPERCONDUCTING PRESSURE GAUGE AT HIGH PRESSURE AND LOW TEMPERATURE

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Le manomètre supraconducteur à basse température

RÉSUMÉ : *L'influence sur la pression de la température de transition de métaux supraconducteurs tels que le bismuth et le plomb est mesurée jusqu'à* 60 kbar.

En utilisant de l'hydrogène solide comme transmetteur de pression, on a mesuré l'influence de la pression sur une température de transition supraconductrice dans plusieurs métaux jusqu'à 10 kbar.

Les AA. ont bloqué la cellule à haute pression à la température ambiante à plusieurs niveaux de pression et l'ont refroidie à la température de l'hélium liquide. Dans le cas de la cellule à haute pression du type cylindre à piston ainsi que dans le cas de la cellule à pression du type à enclume, l'homogénéité de la pression hydrostatique n'est pas suffisante, mais les AA. les ont utilisées jusqu'à une pression supérieure à 10 kbar *et ont mesuré l'influence de la pression sur la transition supraconductrice de plusieurs métaux.*

1 — Introduction

Recent investigations at high pressure and low temperature have been made in the field of solid state physics. Although accurate pressure scales have been determined up to 100 kbar at room temperature and above, pressures at low temperature are not easily measured. The main reason is lack of a hydrostatic pressure transmitting medium at low temperature. Even liquid helium, the lowest boiling substance available, is a solid above ~ 130 bar at 4 K.

Several methods for attaining nearly hydrostatic pressure at low temperature have been described by Swenson [1], Stewart [2], Brandt [3], and Itskevich [4]. In general their simple piston-cylinder type cells can be used to a maximum pressure of only 20 kbar because of limited cylinder strength. In order to attain higher pressures, Wittig [5], Buckel [6], Köhnline [7], and Brandt [8] have used anvil type cells, developed by Chester and Jones [9].

The purpose of this paper is to discuss in some detail the generation of pressure at low temperature and to examine the pressure dependence of the superconducting transition in tin as a possible pressure gauge.

2 — High pressure apparatus

We have made two types of high pressure apparatus for use at low temperature. One is a direct piston-displacement apparatus, the other is a clamped-cell apparatus.

A — Direct piston-displacement apparatus

This basic form consists of a piston-cylinder cell at cryogenic temperature actuated through poorly conducting compression and tension members by a high pressure oil system at room temperature.

The tension component was made from a stainless steel (SUS. 27) tube 70 cm long. The compression member was a stainless steel rod operating inside the tube. For the high pressure piston-cylinder (30 × 8 × 30 mm), we used an alloy of copper and beryllium (1.82% Be) which is nonmagnetic. We were able to measure the magnetic