Reprinted from JAPANESE JOURNAL OF APPLIED PHYSICS
VOL. 11, NO. 4, pp. 591~596, APRIL, 1972

Clamp Type High Pressure Apparatus Using Small Bridgman Anvil at Low Temperature

Genshiro Fujii, Yasukage Oda and Hiroshi Nagano

technique of the measurement of a.c. magnetic susceptibility. The pressure in this high pressure cell is calibrated by the phase transition of Bi I-II, III-V, Tl I-II and Sn I-II at room temperature, and by the pressure dependence of superconductive transition temperature of tin at low temperature. In this paper, the design of the pressure apparatus, its pressure calibration and the methods in measuring of the resistance and susceptibility are discussed.

§ 2. Clamp Type High Pressure Apparatus

Clamp type high pressure apparatus which accepts a small Bridgman anvil is most convenient to obtain the extreme conditions of lower temperature and higher pressure. Furthermore, this apparatus can avoid excessive helium consumption.

Thus we have built a clamp type cell used a small Bridgman anvil (4.0 mm face) geometry which is made from tungsten carbide. This has mainly two advantages as follows; the first is to have used the flange type for clamping mechanism and the second is to have developed an a.c. mutual inductance method for measuring the superconductive transition temperature using weakly ferromagnetic tungsten carbide anvil.

Wittig[6] had used a mechanism which clamped a Bridgman anvil tightly each other with an attached screw nut.

At first, we had used Wittig's mechanism. But in that way, we had often troubled to break of lead wires during the clamping process because the lead wires are twisted when the screw nut is tightened to clamp. Therefore, we have improved Wittig's cell in several points. The high pressure cryostat is shown in Fig. 1. As shown in Figure 2, to clamp a sample, two flanges and three bolts are used. This type is convenient to exchange the sample and is free from the twist of lead wires. Moreover, using this cell, one can adopt an a.c. method of a measurement which means a no-lead wire method so it is convenient to avoid the trouble of the lead wire discussed above. The material of the high pressure apparatus at low temperature is one of serious problem. Most steels become brittle at low temperature. In general, steels with low carbon and high nickel content (austenitic stainless steel) are sufficiently ductile at low temper-

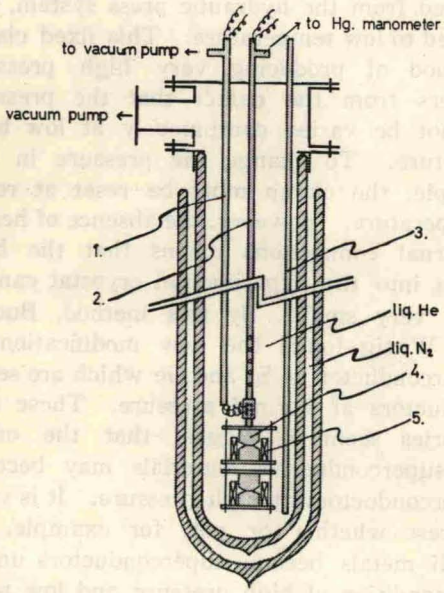

Fig. 1. High pressure cryostat.
1. Vacuum stainless steel tube. Electrical lead wires for measuring the a.c. mutual inductance pass through this tube.
2. Stainless steel tube which supports the high pressure clamp apparatus. Electrical lead wires for the d.c. measurement pass through this tube.
3. Inlet for the liquid helium.
4. Tungsten carbide anvil.
5. Measuring coil.

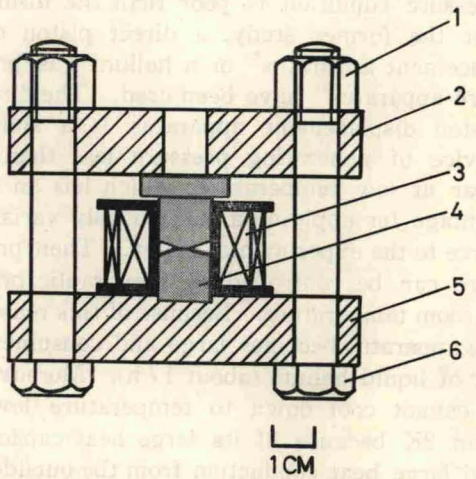

Fig. 2. High pressure clamp apparatus.
1. Fixing nut.
2. Upper flange.
3. Measuring coil.
4. Tungsten carbide anvil.
5. Lower flange.
6. Clamping nut.