

A simple apparatus for the measurement of thermoelectric power in the temperature range 4·2–300 K

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MS received 24 July 1987

Abstract. A simple apparatus to measure the absolute thermoelectric power of solids in the temperature range 4·2–300 K is described. The cryostat and the associated instrumentation is simple to operate. Representative data of measurements on metallic wire and pressed pellets are given. An accuracy of better than 10% in absolute thermopower can be obtained in this apparatus.

Keywords. Thermoelectric power; low-temperature.

PACS Nos 06·60; 72·15; 72·20

1. Introduction

The Seebeck coefficient is an extremely sensitive property whose study as a function of temperature would give valuable information on the electronic structure of the system under study. The Seebeck coefficient is defined in a simple way as follows

$$S = \lim_{\Delta T \rightarrow 0} \Delta E / \Delta T$$

where E is the differential voltage developed across the sample for a temperature difference T .

Thermoelectric power (TEP) can be measured using the differential technique wherein we create a temperature gradient across the sample and measure the voltage developed between the hot and cold ends of the thermocouple formed with a reference material. With the cold end of the sample connected to the positive of the measuring instrument the sign of the voltage developed gives the sign of the thermopower difference between the sample and the reference material. We describe in this paper a simple apparatus developed in our laboratory to measure thermoelectric power in the temperature range 4·2–300 K. There are many descriptions of TEP measurement in the literature (Eckland and Mabatah 1977; Wieder 1979). The technique that we have developed uses very simple instrumentation and it is easier operationally than many of the reported techniques. The purpose of the present paper is to provide necessary experimental details which are generally absent in other papers. It has been developed mainly for polycrystalline samples whose thermal conductance is not too high. A slight modification will also allow it to be used with other type of samples like a metallic strip or a metallic wire. We give below a description of the cryostat and the method of measurement. Some representative data taken using the apparatus are also shown.