Four Probe Setup

FP-01

SES Instruments Pvt Ltd.

Four Probe Set-Up for Measuring the Resistivity of Different Samples at Different Temperature from -170 to 200C

Description

The Four Probe Method is one of the standard and most widely used method for the measurement of resistivity. In its useful form, the four probes are collinear. The error due to contact resistance, which is significant in the electrical measurement on semiconductors, is avoided by the use of two extra contacts (probes) between the current contacts. In this arrangement the contact resistance may all be high compare to the sample resistance, but as long as the resistance of the sample and contact resistance's are small compared with the effective resistance of the voltage measuring device (potentiometer, electrometer or electronic voltmeter), the measured value will remain unaffected. Because of pressure contacts, and 2 way motion, the arrangement is specially useful for quick measurement on large samples at room temperature.

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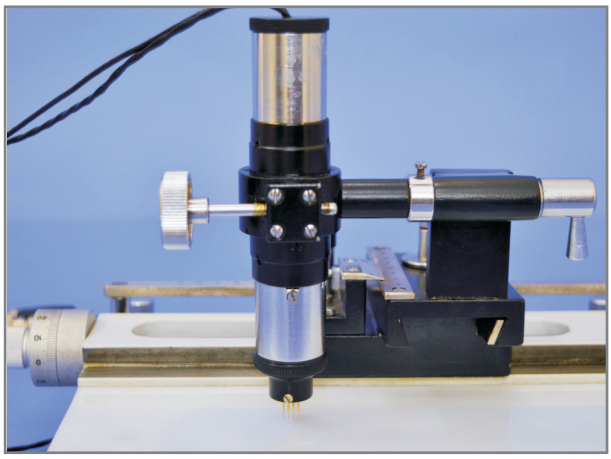
Description of Experimental Set-up

1. Probes Arrangement



It has four individually spring loaded probes. The probes are collinear and equally spaced. The probes are mounted in a teflon bush, which ensure a good electrical insulation between the probes. A teflon spacer near the tips is also provided to keep the probes at equal distance. The probe arrangement is mounted in a tube, which also provide leads for connections to ConFour Probe Control Unit. The tube containing four probes is mounted on a travelling microscope type system, scales and verniers are made of stanless steels with following specification:

Horizontial: 20 cm least count 0.001 cm

Laterial : 6 cm least count 0.001 cm

Vertical : 15 cm least count 0.001 cm

The bed is of heavy casting, thoroughly aged and machined, is fitted with leveling screws. A large platform is provided for fixing the sample.

3. Control Unit of Four Probe Setup

The unit comprises of two sections – a totally isolated constant current source, and a grounded voltage measurement system. Features of these two sections are described below in some detail.

(A) Constant Current Source

It is an IC regulated current generator that is galvanically isolated from the rest of the circuit which is a basic requirement of four probe method. The isolation is achieved by using an optically coupled amplifier and associated circuits. This circuit sends a constant Current. To the changing resistance of the sample due to change in temp

A judicious choice of the current setting as detailed in the user manual is necessary depending on the resistance value that is measured. Brief technical details of the current section are as under:

- Current Range: 2μA, 20μA, 200μA, 2mA, 20mA and 200mA with over ranging
- Open Circuit Voltage: 15V in the lower four ranges and 9V in the upper two
- Accuracy : ±0.25% of the reading ±1digit
- 4-line LCD display with indication when current needs decreasing

(b) Digital Voltmeter Section

The voltmeter is used to read the voltage developed between the middle pins of the four probe arrangement. A primary requirement is to have very high input resistance so that the measurement is not disturbed in case of high resistance samples. The input range of the voltmeter is thus limited by avoiding the use of any potential divider. Brief technical details are as under:

- Voltage Range: 2mV, 20 mV, 200 mV, 2V with over ranging
- Manual adjustment of Offset Voltage whenever current/voltage range is changed
- Accuracy : ±0.25% of the reading ±1 digit
- 4-line LCD display with over voltage indication

In addition to the above, the Four Probe Setup as well as the PID Oven cum Cryostate Unit may be connected to a computer for data logging purposes. Necessary hardware and software are optional and available separately.

The setup is complete in itself