BOOK REVIEW

Nanotechnology Measurement Handbook: a Guide to Electrical Measurements for Nanoscience Applications

Pp. iv + 104 + 30 pages of Appendices. (Cleveland, Ohio: Keithley Instruments, 2006) (ppk).

This is a slim volume extolling the virtues of Keithley's instruments for measuring the electrical properties of materials at the nanoscale.

The introduction sets the scene for measurements at the micro- and nanoscale where resistance in microohms and currents in femtoamps are typical. The problems of noise interference are explained and measurement techniques to reduce the impact are described, together with the practical necessity of user-friendly instruments in order to gather reliable data.

Voltage and current measurement techniques optimized for the device under test are elucidated, together with problems specific to the nanoscale, where quantum band gap effects are present. The pitfalls of low-level measurements are described, and their alleviation through awareness of settling times, leakage currents and thermal noise are explained

For AC/DC measurements, lock-in or phase-sensitive detection is proposed. At the nanoscale, quantum effects can result in an apparent breakdown of Ohm's law when making measurements. Resistance has a stepwise character in relation to current and voltage and the meaning of the results of such measurements needs to be carefully analysed.

A whole section is devoted to nanowire measurements using AFM probes, noting that with many junction devices employing nanowires, currents of many microamps are often present.

The book ends with a list of the best instruments for any given application; naturally all the instruments mentioned are made by Keithley. However, there are many generally useful tips in terms of measurement techniques in order to avoid misleading measurements due to interference when operating with ultrasmall quantities.

G.C. HOLT

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