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Characterization of positional errors and their influence on micro four-point probe measurements on a 100 nm Ru film - DTU Orbit (08/11/2017)

Characterization of positional errors and their influence on micro four-point probe measurements on a 100 nm Ru film
Thin-film sheet resistance measurements at high spatial resolution and on small pads are important and can be realized with micrometer-scale four-point probes. As a result of the small scale the measurements are affected by electrode position errors. We have characterized the electrode position errors in measurements on Ru thin film using an Au-coated 12-point probe. We show that the standard deviation of the static electrode position error is on the order of 5 nm, which significantly affects the results of single configuration measurements. Position-error-corrected dual-configuration measurements, however, are shown to eliminate the effect of position errors to a level limited either by electrical measurement noise or dynamic position errors. We show that the probe contact points remain almost static on the surface during the measurements (measured on an atomic scale) with a standard deviation of the dynamic position errors of 3 Å. We demonstrate how to experimentally distinguish between different sources of measurement errors, e.g. electrical measurement noise, probe geometry error as well as static and dynamic electrode position errors.

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