Hall effect measurement for precise sheet resistance and thickness evaluation of Ruthenium thin films using non-equidistant four-point probes

We present a new micro Hall effect measurement method using non-equidistant electrodes. We show theoretically and verify experimentally that it is advantageous to use non-equidistant electrodes for samples with low Hall sheet resistance. We demonstrate the new method by experiments where Hall sheet carrier densities and Hall mobilities of Ruthenium thin films (3-30 nm) are determined. The measurements show that it is possible to measure Hall mobilities as low as 1 cm²V⁻¹s⁻¹ with a relative standard deviation of 2-3%. We show a linear relation between measured Hall sheet carrier density and film thickness. Thus, the method can be used to monitor thickness variations of ultra-thin metal films.

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