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Magneto-Resistance and Magneto-Impedance of Iron Single Crystals

Matthäus Langosch, Haibin Gao, Uwe Hartmann

Experimental Physics, Saarland University, Campus C 6 3, D-66123 Saarbrücken, Germany

The growing interest in magneto-impedance (MI) effects is mainly due to the possible utilization in high-sensitivity magnetic field detectors and magnetic recording heads. Because of their very simple domain structure iron whiskers were chosen as model samples for basic investigations on the origins of MI effects. $\langle 100 \rangle$ oriented iron single crystals were grown by hydrogen reduction of ferrous chloride. At room temperature the MI was measured by a four probe method at applied longitudinal magnetic field. The measurements covered a large frequency range and were performed on various whiskers of different sizes. Surprisingly, MI effects up to 20% were measured. The data also yields 'ordinary' magneto-resistance (MR) contributions. The individual contributions of the MI and MR effects are discussed in detail on the basis of correlations between the field-dependent domain structure and the resulting impedance.