

Simultaneous magnetoresistance measurements and Kerr microscopy of iron whiskers

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Iron whiskers 70 μ to 105 μ in diameter have been used for the experiment. These whiskers were grown by hydrogen reduction of FeCl_2 at 710°C with low index axes along $\langle 100 \rangle$ and $\langle 111 \rangle$ directions. Measurements of magnetoresistance and (giant) magnetoimpedance at the iron single crystals have been carried out at room temperature as a function of applied longitudinal magnetic field, current amplitude and current frequency. Simultaneously, the magnetic surface domain structure of the probes was imaged by magneto-optical Kerr (MOKE) microscopy. The domain structure dependent on field and current, and the dependence of the impedance on field, current and frequency are most consistently explained as the low-frequency onset of "giant magnetoimpedance". In conclusion, the magnetoimpedance in iron whiskers can be understood in close analogy to the giant magnetoimpedance known from amorphous wires with an alternating circumferential domain structure.