Magnetic Properties of Fe-based Composite in Small Magnetic Field.

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Abstract. In this study, we investigated the behavior of a soft magnetic composite (SMC) based on iron (Fe) in low magnetic fields. The composite material consists of ferromagnetic particles with sizes ranging from 200 to 400 μm, individually insulated by a SiO_2 layer. Details of the sample preparation procedure can be found in [1].
We measured a series of hysteresis loops on this SMC sample, with the maximum applied external magnetic field ranging from 24 A/m to 620 A/m. This range is broad enough to meet the criterion for remagnetization in the Rayleigh law validity area. We adopted the commonly accepted criterion for the Rayleigh region, which sets the maximum magnetic field at one-tenth of the material's coercivity. The coercivity of the tested material is 690 A/m.
Our results indicate that the generally accepted criterion for the Rayleigh law validity area is very strict and in the case of the used sample, it is possible to use the hysteresis loop constants up to a maximum value of magnetic field up to180 A/m for the analysis of the initial permeability and Rayleigh constants. Furthermore, accurate analysis of initial permeability and Rayleigh constants requires plotting hysteresis loops as functions of the internal magnetic field. This internal field is calculated by correcting the external field for the demagnetizing field, using an experimentally determined internal demagnetization factor.

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[1]. R. Maciaszek, P. Kollár, Z. Birčáková, M. Tkáč, J. Füzer, D. Olekšáková, D. Volavka, T. Samuely, J. Kováč, R. Bureš, M. Fáberová, Effects of particle surface modification on magnetic behavior of soft magnetic Fe@SiO2 composites and Fe compacts