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Targeted use of residual stresses in electric sheet to increase energy efficiency

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Electrical steel sheets are used in electric drives to guide the magnetic field and their efficiency strongly depends on energy losses during the reversal of magnetization. The energy loss is coupled to the mobility of the magnetic domains, which is negatively affected by stress caused during the manufacturing process [1, 2]. Neutron grating interferometry (nGI) allows to probe the bulk local magnetic properties in samples of technically relevant dimensions, which is not possible with most other techniques by tracking the amount of ultra-small-angle-neutron scattering inside a sample [3]. The DFI image is related to the distribution and size of magnetic domains inside a sample serving as possible scattering centers and allows to track the degradation of magnetic domain wall mobility caused by stress.

In this project we use the degradation of the magnetic domains by targeted stress to actively guide the magnetic field, allowing to build more efficient electrical drives. We will give an overview about the achieved results in flux guidance using various embossing strategies. Moreover we present an outlook on future experiments. This project is a collaboration with the utg (TUM) and IEM (RWTH Aachen) as part of the DFG priority program SPP2013

[1] H. Weiss et al., J. Magn. Mater. 474, 643–653 (2018)

[2] A. Moses, IEEE Trans. Magn., Vol. 15, 1575-1579 (1979)

[3] C. Grünzweig, PhD thesis (2009)

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