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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. The efficiency of an electrical steel sheet strongly depends on the amount of energy lost during the reversal of magnetization, which is dependent on the mobility of the magnetic domains. The mobility of the magnetic domains is influenced by stress caused during the manufacturing process. [1],[2].

To probe the magnetic domain constellation in bulk samples of technically relevant dimensions neutron grating interferometry (nGI) is the technique of choice, as it allows to probe the bulk local magnetic properties, which is not possible with most other techniques.

nGI provides information about the amount of ultra-small-angle-neutron scattering inside a sample [3]. The resulting image (DFI) is sensitive to the distribution of magnetic domain walls, which serve as possible scattering centers. Hence the DFI signal is related to the distribution and size of magnetic domains inside a sample, allowing 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.

This project is done together with the utg (TUM) and IEM (RWTH Aachen) as part of the DFG priority program SPP2013 .

[1] H. Weiss et al., pending (2018)

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

[3] C. Grünzweig, PhD thesis (2009)

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