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Internal stress in electrical steel sheets – Effects and Applications –

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Electrical steel sheets are used in transformers as well as in electrical motors 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 mainly influenced by internal 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 (USANS) 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 local distribution and size of magnetic domains inside a sample.

We will show how internal stress affects the local hysteresis of an electrical steel sheet, causing a degradation of the magnetic domain mobility. Furthermore, we will show how an intended use of this effect, due to imprinting on the electrical steel sheets can increase the efficiency of an electrical engine.

[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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