Hysteresis modelling in additively manufactured FeSi magnetic cores

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An advanced magnetic hysteresis modelling, exploiting the Preisach theory and the neural networks, is applied and discussed for the simulation of the magnetization processes of magnetic components made by laser powder bed fusion. Silicon iron samples with different percentage silicon content are used for the evaluation of the accuracy and reliability of the proposed approach. Measurements of the hysteresis loops and energy losses are compared with the computed results for different magnetization amplitudes and frequency rates. This approach is presented and evaluated here to provide a method for the accurate representation of the magnetization processes and the prediction of energy losses involved in additively manufactured ferromagnetic cores, in order to optimize their energy efficiency along different applications.

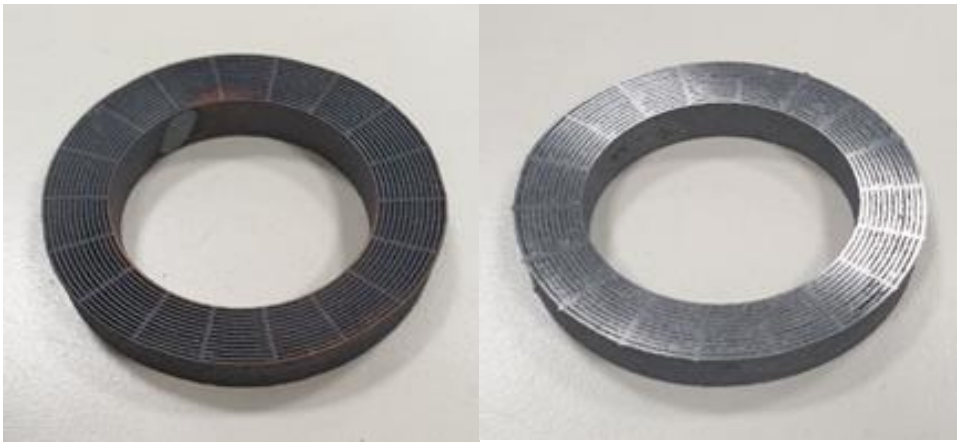

Figure 1: (left) Toroidal sample with 3 wt.% of Si content, (right) toroidal sample with 6.5 wt.% of Si content.

The computational accuracy is affected by several aspects. First of all, the measurements accuracy and the number of data set experimentally extracted. Secondly, the effectiveness of the identification procedure of the hysteron distribution for the Preisach model, and finally the structure of the used neural networks. We propose and describe schemes procedures, and parameters values that can be used to obtain a computational tool with satisfactory effectiveness and reliability.

References

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