Abstract for ICM 2015: A novel experimental determination of the magnetometric self-demagnetization factor

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Machine designers and advanced material manufacturers are in need of a robust, practical and accurate measurement technique, capable of determining permanent magnet properties for operating conditions. Recent techniques based on pulsed field magnetometry offer this capability, with the measurement of the full BH loop taking less than 100 ms. However, for these techniques to reach the required accuracy and robustness, detailed investigation into the associated correction factors is required. One such correction, which is associated with the geometry and susceptibility of the test sample, is the magnetometric self-demagnetization factor, N_D. This correction and the associated phenomenon of self-demagnetization are explained in detail in the work of Chen et al. [1] and have thus far been theoretically calculated using an inductance model. This work will introduce a novel experimental determination of N_D based upon a measurement of the working point polarisation, J_m , and the second quadrant demagnetization curve. In this study, a series of cylindrical NdFeB samples were investigated, with aspect ratios ranging from 1 up to 3, where 1 represents a cylinder 10 mm in length and 10 mm in diameter. The experimental and theoretical values of N_D are presented and found to have discrepancies of up to 40%. This significant difference is attributed to over simplifications of the susceptibility used in the theoretical models. Data from the Pulsed Field Magnetometer (PFM) at the National Physical Laboratory is then processed using these values, with the experimentally determined N_D resulting in behaviour closer to that of the known material behaviour. This paper will present for the first time these measurements of N_D and discusses the complex self-demagnetization correction required to obtain material properties using a PFM.

[1] D-X. Chen, J.A. Brug and R.B. Goldfarb, *"Demagnetizing Factors for Cylinders"*, IEEE Transactions on Magnetics, vol. 27, pp. 3601-3619, July 1991