13 novembre 11:00 -13:00

Dipartimento di Ingegneria
Aula interna (ex DII)

INRiM
ISTITUTO NAZIONALE
DI RICERCA METROLOGICA

Torino
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The **ferromagnetic materials**: fundamentals, measurements, and interlaboratory comparison

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The first part of the seminar introduces the basic features of ferromagnetic materials, specifically the hysteresis loop, and the experimental principles and techniques adopted for their characterization. To this end, the Epstein frame method is discussed in particular.

In the second part, a comparison performed by four different European laboratories regarding the measurement of magnetic energy losses in non-oriented Fe–Si sheets under alternating and rotational fields is reported.

The laboratories used different Rotational Single Sheet Testers (RSST) with independently developed hardware and software tools and methods. Both open and closed magnetic circuits were employed, using circular and single-strip samples.

The measurements, performed in the frequency interval 5 Hz $\leq f \leq$ 200 Hz, with peak polarization values 1.0 T $\leq J_p \leq$ 1.5 T, were traced to reference loss figures secured by Epstein test frame experiments, covering the same matrix of J_p and f values. The effective field across the measuring region was measured in all laboratories using calibrated tangential H-coils. The comparison of the laboratory-averaged RSST alternating loss figures with the reference values shows differences roughly ranging between ± 5 %. These discrepancies and their trend with J_p are calculated and predicted to descend from the inhomogeneity of the demagnetizing field across the sensing area. This phenomenon affects the measurement reproducibility and leads to an overall dispersion of the laboratories' best estimates of the rotational loss figures, quantified by a relative standard deviation s = 3.6 %. This figure is significantly reduced with respect to a previous international comparison launched in the '90s.