Warming a Magnetic Shield Changes it's Properties*

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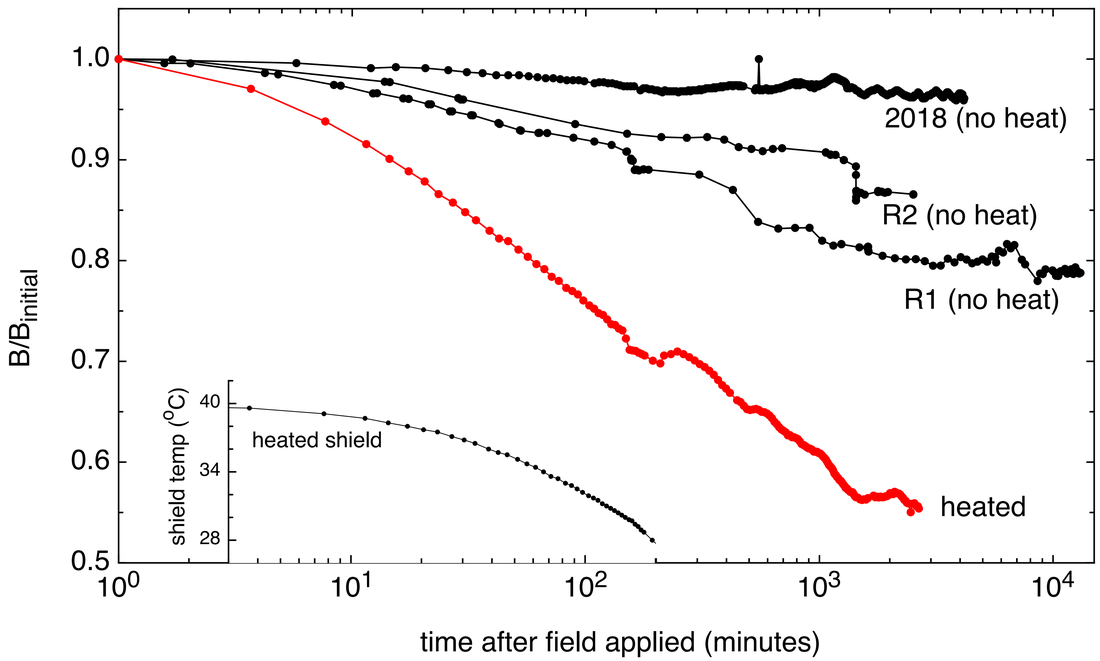
The experiment

Magnetic shield test stand

1. Null Earth's magnetic field in three directions.
2. Mount 25 cm diameter, 81 cm long shield on test stand.
3. Warm the shield to > 45 ^{o}C. Turn off heating current.
4. Demagnetize shield with 60 Hz current through toroidal winding. Slowly ramp current to zero. Wait 10 min.
5. Apply magnetic field of $\mu_o H$ = 20,000 nT.
6. Measure the magnetic flux density (B) inside shield over time.
7. Compare with room temperature shield results.

A warmer magnetic shield relaxes faster



Relative magnetic flux density over time for a 25 cm diameter magnetic shield warmed to 40 ^{o}C (red) and at room temperature (black) after application of fields of $\mu_o \mathbf{H}$ = 20,000 nT.

R1 and R2 are data from our earlier paper. The insert shows the temperature of the heated shield as a function of time

Interpretation

In our 2018 AIP Advances paper, we attributed delayed changes in magnetization to barriers to domain wall rearrangement that are overcome by thermal activation.

If this Arrhenius type model is correct, the relaxation rate should increase with temperature, which we have here observed. Future experiments will be performed with a constant elevated temperature.

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