

Demagnetisation study of pulse-field magnetised bulk superconductors

J. Srpčič¹, Student Member, IEEE, D. Zhou¹, K. Y. Huang¹, Y. Shi¹, A. R. Dennis¹, M. D. Ainslie¹, Senior Member, IEEE, R. Bause², M. Boll², M. Filipenko², D. A. Cardwell¹, J. H. Durrell¹

¹ Bulk Superconductivity Group, Department of Engineering, University of Cambridge

² Siemens AG

In this study we investigated the effect of external AC magnetic fields on the rate of trapped-field decay in GdBCO bulks, magnetized with PFM. We found that:

- **Controlling the temperature** after magnetisation provides a reliable way of **reducing decay** of trapped field for the AC fields we applied (150 mT amplitude at a frequency of 6 Hz).

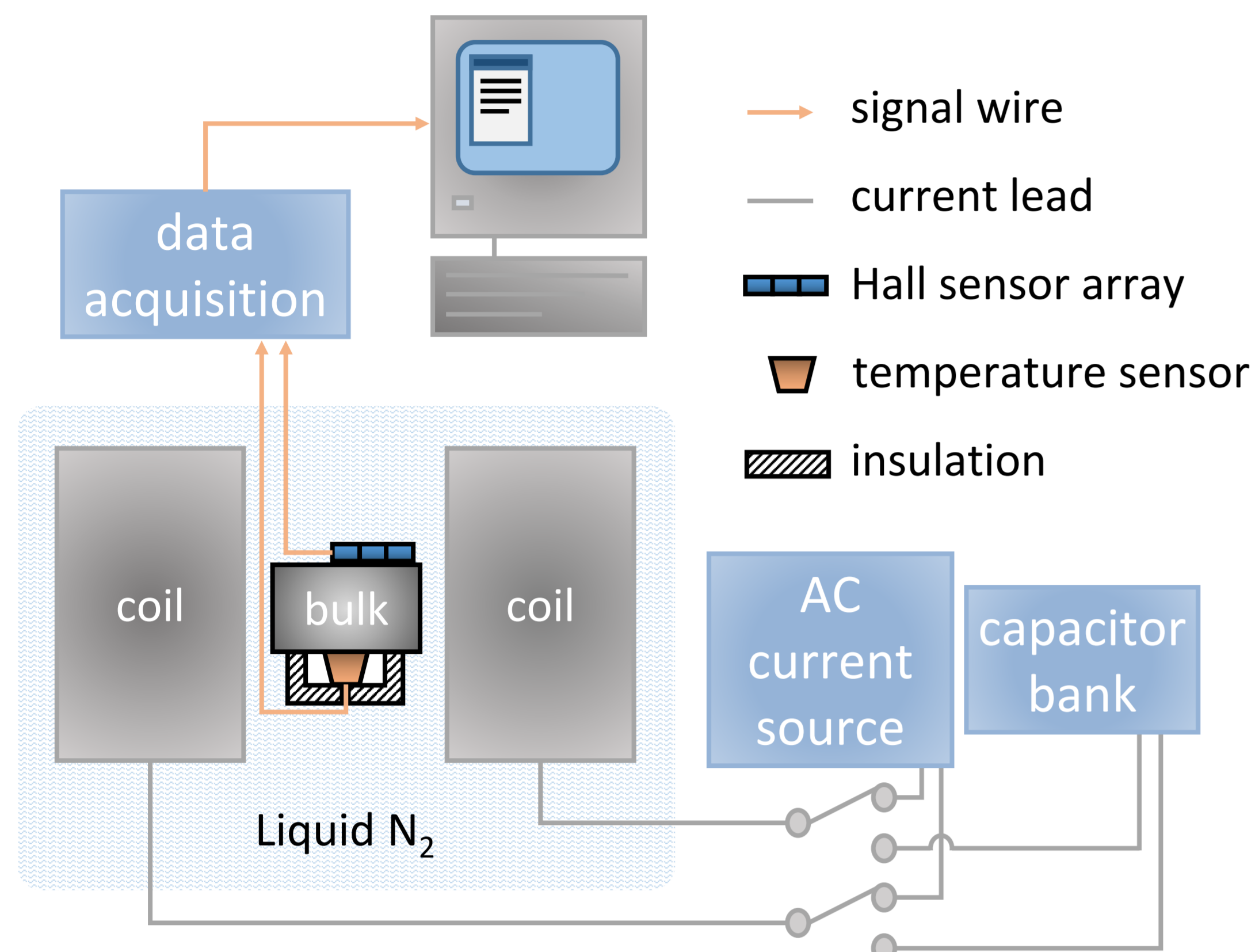


Fig. 1. Experimental setup.

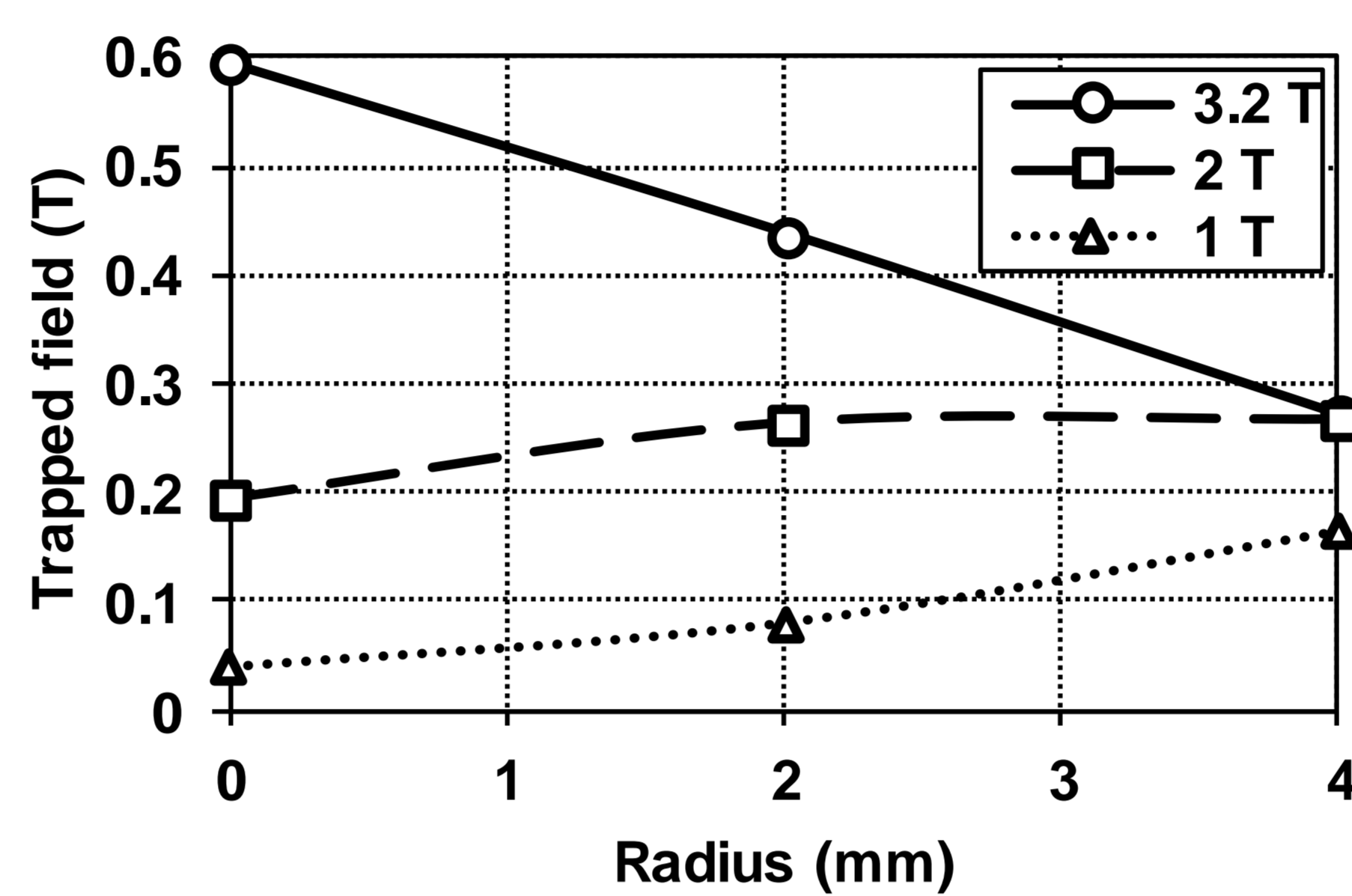


Fig. 2. Trapped field profile 10 min. after PFM for three different pulse peaks.

- **Temperature rise does not contribute significantly to decay.** For applied AC fields of amplitude up to 45 mT and frequency up to 48 Hz at 77 K, the temperature rise was found to be at most around 100 mK.

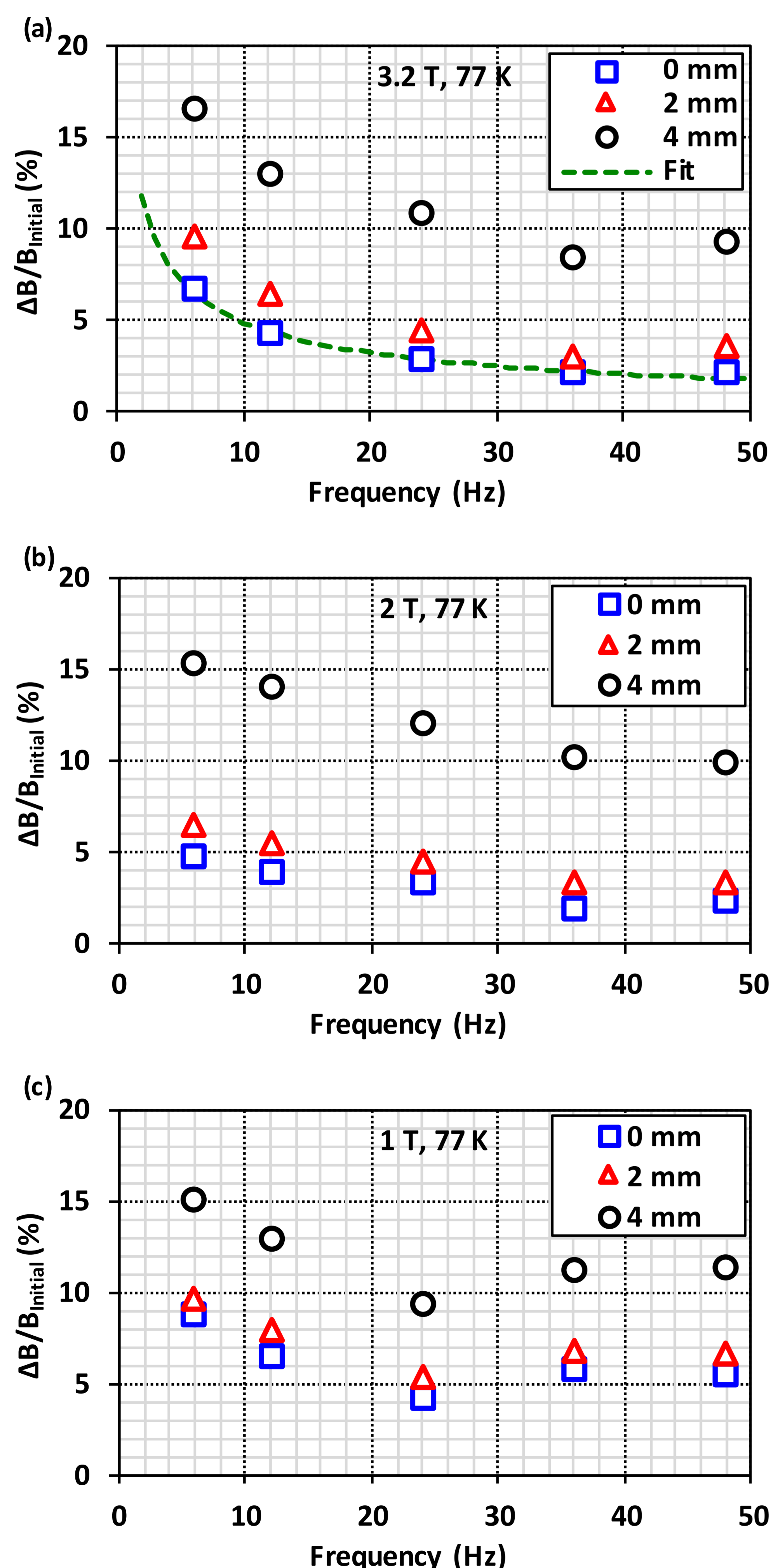


Fig. 3. Frequency dependence of decay ΔB after 5000 cycles of AC field following each of the initial magnetizations. Dashed green line in (a) is a least-square fit to the 0 mm data of an $\omega^{-1/2}$ frequency dependence.

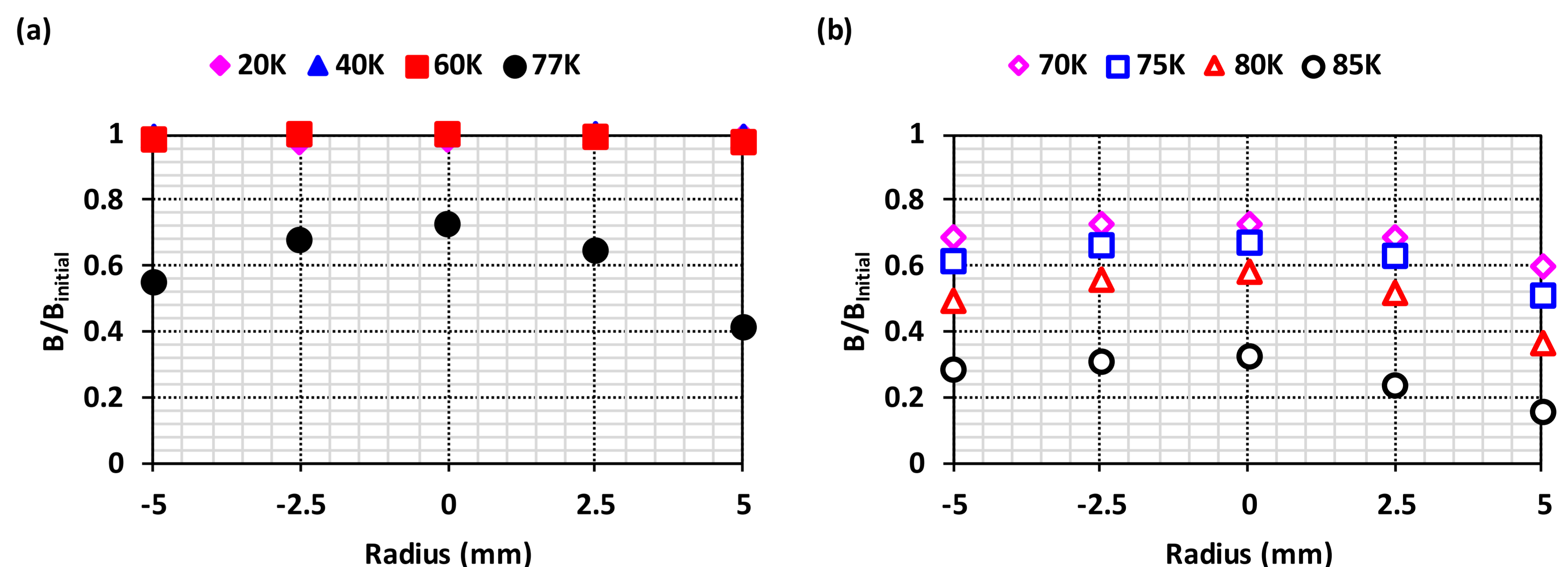


Fig. 4. (a) Trapped field decay after 5000 cycles of 150 mT (peak) AC field with frequency 6 Hz at different temperatures after PFM at 77 K. (b) Trapped field B after 5000 cycles, divided by initial trapped field B_{Initial} of a fully magnetised bulk at each respective temperature (70 K, 75 K, 80 K or 85 K).

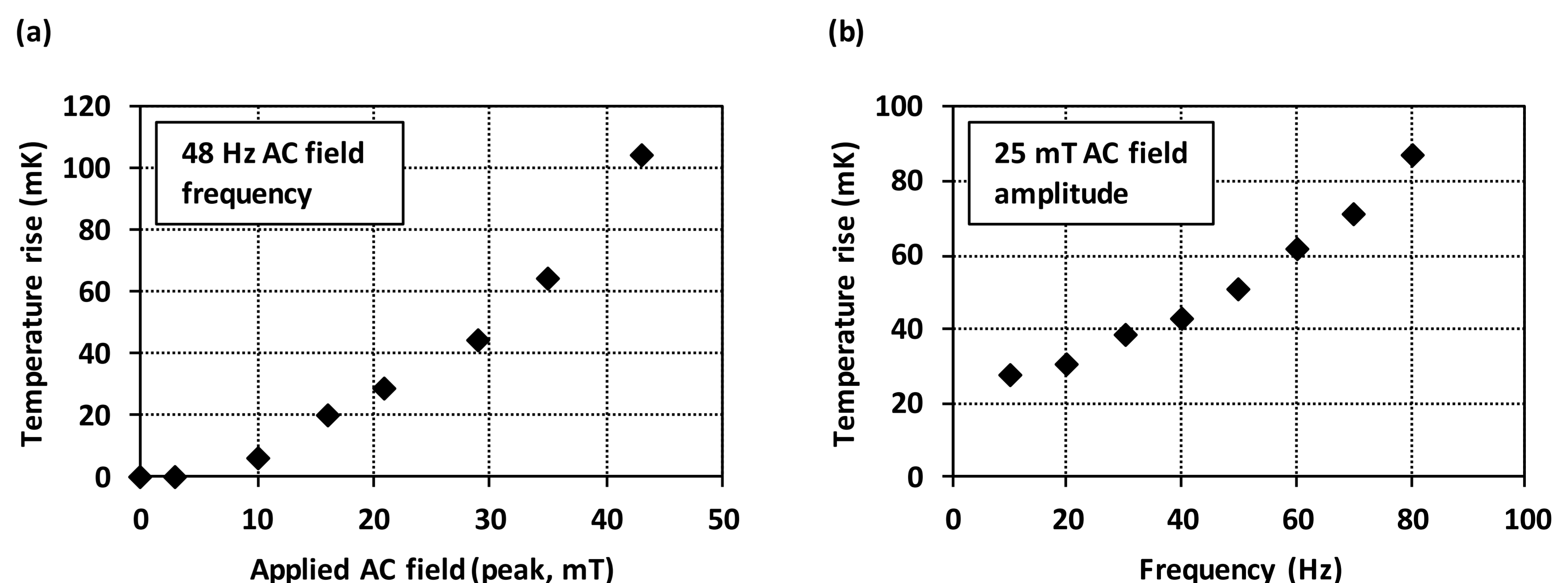


Fig. 5. (a) Temperature rise on the bulk surface during 48 Hz AC field application for different field values (in liquid nitrogen). (b) Temperature rise during 25 mT (peak) AC field applications for frequencies up to 80 Hz (in liquid nitrogen).

Acknowledgement

This work was supported by Siemens AG Corporate Technology, Munich, Germany. The work of M. D. Ainslie was supported in part by a Royal Academy of Engineering Research Fellowship and in part by an Engineering and Physical Sciences Research Council (EPSRC) Early Career Fellowship EP/P020313/1.