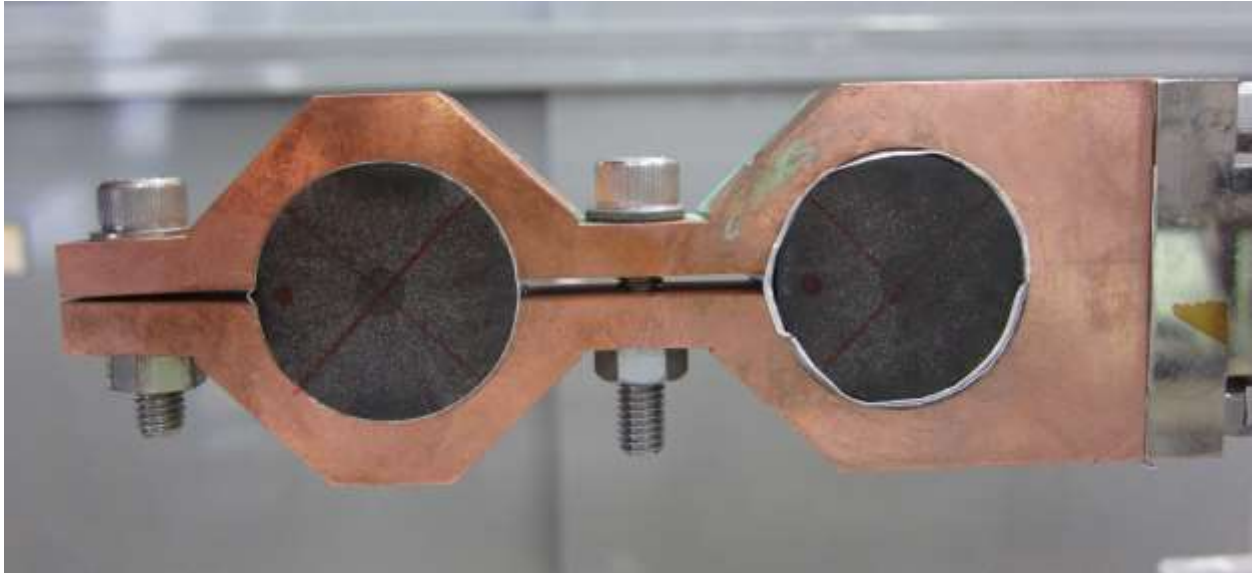


The Bulk Superconductivity Group, led by Professor David Cardwell, has been working closely with Professors Hiroyuki Fujishiro (Iwate University) and Mitsuru Izumi (Tokyo University of Marine Science and Technology) on the processing of bulk high-temperature superconductors and their application as super-strength, permanent magnet alternatives in superconducting electrical machines.

The collaboration was funded by a JSPS Bilateral Joint Research Project and the Cambridge side, led by Royal Academy of Engineering (RAEng) Research Fellow Dr Mark Ainslie, was funded by a Royal Society International Exchange Scheme grant (2014-2016). Dr Ainslie initiated the collaboration with Prof. Fujishiro after discussions at the Applied Superconductivity Conference 2012 in the US. Dr Ainslie then spent six weeks visiting the two Japanese groups, funded by his RAEng Research Fellowship and an Institution of Engineering and Technology (IET) Travel Award (<http://conferences.theiet.org/achievement/travel/travel-report-markainslie.cfm>).

The JSPS and Royal Society funding has facilitated research visits to Japan and the UK for several researchers and enabled extremely useful information exchange between the research groups, as well as joint technical research in the respective research labs. This has resulted in over a dozen joint papers together already, including two papers that were selected by the journal Superconductor Science and Technology (SUST) as their Highlights of 2015. One of these, a topical review paper on the modelling of bulk superconductor magnetisation published by Dr Ainslie and Prof. Fujishiro, has been downloaded over 4,000 times and resulted in an eBook contract with the Institute of Physics. They also achieved a new record trapped magnetic field of 1.1 Tesla in a bulk magnesium diboride ( $MgB_2$ ) superconductor, magnetised by the pulsed field magnetisation technique, in 2016 (<http://www.eng.cam.ac.uk/news/bulk-superconductor-magnetic-field-record-achieved>). Additionally, Dr Ainslie, Prof. Izumi and Dr Motohiro Miki worked together as guest editors of a successful focus issue on superconducting rotating machines for SUST.

Dr Ainslie was recently awarded a five-year, £1.1 million EPSRC Early Career Fellowship (<http://www.eng.cam.ac.uk/news/superconductivity-expert-awarded-prestigious-early-career-fellowship>) with Prof. Fujishiro as a close collaborative partner, enabling the groups to continue to work together on the pulsed field magnetisation of bulk high-temperature superconductors for portable, high field magnet systems, and we are all looking forward to the opportunity to continue to address the key technical challenges in our research field in the future and hope to seek additional funding to support this endeavour.



Sample holder for split-coil pulsed field magnetisation experiments carried out in Prof. Hiroyuki Fujishiro's lab in Japan, with two of the Cambridge Bulk Superconductivity Group's Gd-Ba-Cu-O bulk high-temperature superconductors. The results were published in M. D. Ainslie et al., "Enhanced trapped field performance of bulk high-temperature superconductors using split coil, pulsed field magnetization with an iron yoke," *Supercond. Sci. Technol.* 29 (2016) 074003 (<http://dx.doi.org/10.1088/0953-2048/29/7/074003>).