Contribution ID: **271** Contribution code: **TUE-PO1-504-09** Type: **Poster**

Validation of a high-gradient trapped field magnet with an open bore providing a quasi-microgravity space on Earth and its application to magnetic levitation

Tuesday, 16 November 2021 13:15 (20 minutes)

A quasi-microgravity space, exploiting a large magnetic field in combination with a large field gradient, is considered for potential applications such as protein crystallization and cell culture without natural convection caused by gravity. To provide a high magnetic field in a more cost-effective way, large-single grain bulk superconductors –such as the RE-Ba-Cu-O (RE: rare earth element or Y) family of materials –have shown promising potential for generating magnetic fields over several tesla as so-called trapped field magnets (TFM). Compatibility between the magnetic performance and flexibility in operation is required to realize a practical TFM device that can provide such high magnetic fields in an open space outside the vacuum chamber. The authors recently proposed a new concept of a high-gradient trapped field magnet (HG-TFM), which consists of slit ring bulks that can generate a downward-oriented magnetic field, are tightly stacked with conventional TFM cylinders [1]. It has been estimated numerically that a magnetic field gradient product over 3000 Tˆ2/m could be realized by field-cooled magnetization (FCM) of such a device, even with a relatively small external field of 9 T at 40 K. This is comparable with the performance of conventional, large-scale hybrid magnets with 20 T. In this paper, to realize the HG-TFM concept experimentally, we report the design of an HG-TFM apparatus with an open bore and confirm the expected magnetic properties experimentally. As the next step, magnetic levitation would be performed for any fundamental, diamagnetic materials to observe the corresponding levitation position and compare these with the numerical results. The extensibility of the proposed HG-TFM device for magnetic levitation will be discussed.

[1] K Takahashi, H Fujishiro and M D Ainslie, Supercond. Sci. Technol., 34 035001, 2021.

Acknowledgements

• Engineering and Physical Sciences Research Council (EPSRC) UK, Early Career Fellowship, EP/P020313/1

Primary author: Dr TAKAHASHI, Keita (Iwate University)

Co-authors: FUJISHIRO, Hiroyuki (Iwate University); AINSLIE, Mark (University of Cambridge)

Presenter: Dr TAKAHASHI, Keita (Iwate University)

Session Classification: TUE-PO1-504 Special purpose magnets I: Field gradients & other applications