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## **Mon-Af-Po1.13-01 [20 & 21] [Invited]: Towards a 1.3 GHz (30.5 T) NMR: Persistent-mode NMR magnet with superconducting joints between high-temperature superconductors**

*Monday 23 September 2019 14:30 (2 hours)*

We will describe the first persistent-mode medium magnetic field (400 MHz, 9.39 T) NMR magnet which uses superconducting joints between high-temperature superconductors (HTSs). As an ultimate goal, we aim to develop a high-resolution 1.3 GHz (30.5 T) NMR magnet operated in the persistent-mode [1]. The 1.3 GHz NMR magnet requires superconducting joints between HTSs and those between an HTS and a low-temperature superconductor (LTS). Towards this goal, we have been developing persistent-mode HTS inner coils to be operated in a 400 MHz (9.39 T) NMR magnet, and here we present the first prototype of an inner coil wound with a single piece REBCO conductor [2]. The coil and a newly developed REBCO persistent current switch (PCS) are connected with intermediate grown superconducting (iGS) joints which can transport very high currents in external magnetic fields. To evaluate the performance of the joints with an ultimately stable and homogeneous magnetic field in a real magnet system, the coil is operated in the persistent-mode, generating 0.1 T, in a 9.3 T background magnetic field of a persistent-mode LTS outer coil. A magnetic field drift rate of this 400 MHz LTS/REBCO NMR magnet is <1 ppb/h, sufficient to obtain high-resolution NMR spectra. The <sup>1</sup>H NMR spectrum line shape gives a half height width of 1 ppb, demonstrating that the superconducting joints perfectly functions in a high-resolution NMR system. As the next development steps, we will develop a REBCO inner coil with many joints and a Bi-2223 inner coil, which coils will also be tested in the 400 MHz LTS/HTS NMR magnet in the persistent-mode.

[1] Maeda et al, submitted to IEEE TAS

[2] Yanagisawa et al, Presented at ASC2018, 4LPo1E-05

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