



Completion of a Superconducting Nb₃Sn Coil for the 45 T Hybrid at the High Magnetic Field Lab in Nijmegen



I.R. Dixon¹, M.D. Bird¹, J.A.A.J. Perenboom², A. den Ouden²

1. National High Magnetic Field Laboratory; 2. Radboud University, Nijmegen, The Netherlands

Funding Grants: G.S. Boebinger (NSF DMR-1157490, NSF DMR-1644779); Dutch FOM and NWO

In March 2018, the MagLab delivered a 7-ton superconducting coil to Radboud University Nijmegen (RUN) which is designed to form the core of a new 45 T hybrid magnet at the Nijmegen High Magnetic Field Laboratory. This is the third Nb₃Sn Cable-In-Conduit (CIC) coil of this complexity and size to be delivered by the MagLab within the past five years.

This coil is the product of a twelve-year collaboration among the MagLab, RUN, the Helmholtz Zentrum Berlin (HZB), Johns Hopkins University, and the Oak Ridge Spallation Neutron Source (SNS). In 2006, the MagLab received funding from the NSF to develop a 36 T, 1 ppm hybrid magnet for ourselves, as well as to design a similar magnet for the SNS. Shortly thereafter, the MagLab received funding from the HZB to develop a similar magnet for their neutron scattering user program. Completing those projects required the MagLab to explain the extreme degradation of Nb₃Sn CIC conductors tested in Europe, as well as to master the science and technology of designing and building these world-record CIC systems. An extensive computational and experimental program resulted in a novel understanding of the thermal strain induced in these multi-scale composites and enabled these systems to be completed. Thirty-six peer-reviewed publications summarize the MagLab's CIC coil and hybrid magnet expertise. In 2012, RUN appreciated the MagLab's unique capabilities in this field of applied superconductivity and contracted with the MagLab for development of this latest system.

The coil winding, reaction, heat-treatment, epoxy-impregnation, and cold-mass assembly occurred in the MagLab's Large Coil Fabrication Shop. The MagLab's contribution to the RUN 45T hybrid magnet project also includes conductor design and structural, thermo-hydraulic, and quench analyses.

Facilities used: Magnet Science & Technology's Large Coil Fabrication Shop

Citation: A. den Ouden, C.A. Wulffers, N.E. Hussey, G. Laureijs, F.J.P. Wijnen, G.F.A.J. Wulterkens, M.D. Bird, I.R. Dixon, J.A.A.J. Perenboom, "Progress in the Development of the HFML 45 T Hybrid Magnet," *IEEE Transactions on Applied Superconductivity*, v. 26, n. 4, June 2016.



Completed Nb₃Sn Superconducting Coil shown at the MagLab (left)...

...and upon delivery to the Nijmegen High Magnetic Field Laboratory (below)

