

Group of Research in Electrical engineering and Electronics of Nancy
Postdoctoral research position - 2011

“YBaCuO Bulk Superconductors Magnetization”

The GREEN, a world-class research laboratory associated with the University of Nancy, France is seeking a postdoctoral research associate (post-doc) to advance research on magnetization of bulk superconductors. The GREEN has been working on non-conventional topologies of superconducting motors based on magnetic shielding with bulk YBCO [1], [2]. New prototypes of motors are investigated using trapped flux in YBCO pellets. One of the key elements to developing superconducting motors with high specific power is to optimize the magnetic flux trapped in bulk superconductors, i.e. more than 2 T [3]. The current record has been established by the Japanese with a flux density of 17 T at 29 K trapped in a pellet of about 2 cm in diameter [4].

Research: There are different ways to magnetize YBCO bulk superconductors also called cryo-magnets. However, the most convenient and most common way to magnetize superconducting pellets is to use a pulsed magnetic field. This method is called PFM for Pulsed Field Magnetization. It allows for strong magnetic fields to be trapped while using a relatively small and simple coil. Thus, the pellet can be directly magnetized into the final application. The parameters that influence the final value of the trapped field are partially identified, but rarely optimized. There are the operating temperature, the cooling efficiency, and the speed of variation and the amplitude of the applied field...

Job description: The objective of the works is to master the PFM process on YBCO pellets from technological and scientific points of view. The candidate will have to design and build an experimental bench to optimize the magnetization of superconducting pellets cooled by a cryocooler.

Research subject: Study and Optimization of Flux Trapping in YBCO Bulk by Pulsed Field Magnetization.

Team: Applications of Superconductors in Electrical Engineering.

Conditions: PhD in Engineering Physics, Electrical Engineering or equivalent.

Conditions of employment: The post-doc will be employed by the GREEN for one year. The funding is provided by the French National Research Agency on a project called REIMS for “Realization of an Inductor of a Superconducting Machine”.

References:

- [1] E. H. Ailam, D. Netter, J. Leveque, B. Douine, P. J. Masson, and A. Rezzoug, “Design and Testing of a Superconducting Rotating Machine,” *Applied Superconductivity, IEEE Transactions on*, vol. 17, no. 1, pp. 27-33, 2007.
- [2] R. Moulin, J. Leveque, L. Durantay, B. Douine, D. Netter, and A. Rezzoug, “Superconducting Multistack Inductor for Synchronous Motors Using the Diamagnetism Property of Bulk Material,” *Industrial Electronics, IEEE Transactions on*, vol. 57, no. 1, pp. 146-153, 2010.
- [3] P. J. Masson and C. A. Luongo, “High power density superconducting motor for all-electric aircraft propulsion,” *Applied Superconductivity, IEEE Transactions on*, vol. 15, no. 2, pp. 2226-2229, 2005.
- [4] M. Tomita and M. Murakami, “High-temperature superconductor bulk magnets that can trap magnetic fields of over 17 tesla at 29 K,” *Nature*, vol. 421, no. 6922, pp. 517-520, 2003.