Magnetization of HTS double pancake coil by the field cooling method with an external magnet

Woo-Seok Kim¹, Seyeon Lee¹, Yungil Kim¹, Ji-Young Lee¹, Sang Ho Park¹, Gye-Won Hong¹, Ji-Kwang Lee², Sung Soo Kim¹, and Kyeongdal Choi¹

¹ Korea Polytechnic University, 237 Sangidaehak-ro, Siheung, Gyeonggi-do, Korea
+82-31-8041-0695, choisdal@kpu.ac.kr
² Woosuk University, 443 Samnye-ro, Wanju-gun, Jeollabuk-do, Korea

Abstract: Since the authors had proposed the concept of wind-and-flip as a winding method to realize an HTS coil with a perfect closed loop so that we could maintain the persistent current in the HTS coil, several magnetization methods have been tried to charge up the HTS coil to the point of the magnetic field we want to produce in the coil. Among the methods to charge a closed HTS coil up, the field cooling method with an external background magnet should be the easiest way because it doesn’t require any additional joints or persistent current switches. However, despite all the advantages, we won’t be able to measure or control the magnet current directly with this magnetization method. The magnet current has to be estimated by measuring the magnetic flux density inside or around the HTS coil in this case. Moreover, the magnetic flux density at the center point of the inside of the HTS coil applied by the background magnet won’t be conserved either, because only the flux linkage of the HTS coil should be conserved. These usually make it barely suitable to magnetize the HTS coil by the field cooling method. This paper tries to figure out the reason of the difference between the magnetic flux density at the center point of the HTS coil by the background magnet and by the magnetized HTS coil after the removing of the background magnetic field. As a result of calculations, the change of the magnetic flux density could be positive or negative depending on the shape and number of turns of the HTS coil. Once we figure out the dependency of the change of the magnetic field, it will be possible to control and set the objective magnet current in the HTS coil when we try to charge it up by the field cooling method.