Characterization of CICC Superconductor Wires

Maria S. Commisso[1], Eric Maire[1], Jean-Yves Buffiere[1], and Daniel Ciazynski[2]

[1]University of Lyon, INSA-Lyon, MATEIS, CNRS UMR5510, F-69621 Villeurbanne, France
[2]Association Euratom-CEA, CEA/DSM/DRFC, CEA/Cadarache, F-13108, Saint-Paullez- Durance, France

E-mail: maria_soledad.commisso@insa.lyon.fr

Abstract — The Nb_3Sn cable in conduit conductors (CICCs) have a multi-stage twisted configuration. The inner structure of CICC such as the twist pitch and void fraction have a substantial impact on the superconductive cable performances. X-ray tomography is a powerful non-destructive technique which can provide 3D images of strands configuration. Therefore, this technique is used to determine the internal structure of the cables which in turn can be used to verify the cabling process and even further for modelling purposes. Additionally, scanning electron microscopy (SEM) analysis has been carried out to show the interaction between strands and to characterize the filaments of superconductive compound. Through an energy-dispersive X-ray spectroscopy (EDX) analysis, a chemical characterization of the superconductive filaments was performed. It was found that the trajectory of some strands was irregular and different to the one defined during cabling. Contacts between strands produces detachments between the central zone and the outer ring of pure copper. Regarding the superconductive filaments, the solid state reaction performed to obtain the superconductive compound was not fully completed and an inner central core composed of pure Nb was obtained in several filaments. Also, a tendency of the Nb filaments to bridge together could be observed and some cracks were seen, especially in those with an inner central core of pure Nb.

Keywords (Index Terms) — Josephson junctions, current-voltage characteristics, tunneling, charge carrier processes, distribution functions.