

Adhesion analysis of resin impregnation systems in superconducting magnets

Tuesday 23 July 2024 14:00 (2 hours)

The mechanical properties of Nb3Sn coils are strongly influenced by the adhesion between the impregnation resin and the coil constituents, which may significantly impact the magnets' performance. To improve the understanding of the parameters governing the adhesion in such superconducting magnets, a study was conducted on the adhesion of several impregnation systems with respect to different coil parts, including copper, stainless steel, aluminium, and glass fibre. The study evaluated the adhesive strength in various test configurations, considering the influence of substrate surface conditions. The effect of cryogenic environment on the adhesion strength of the most commonly used epoxy resin was also studied. The contact angles and surface energies of substrates were measured under varying conditions and wetting analysis was carried out. Additionally, the surface tension of the resins was measured, and an adhesion analysis was performed. The experimental adhesion results were found to be in accordance with the theoretical predictions of the adhesion analysis. The obtained results provide insights into potential modifications of the epoxy resin formulation and surface treatment methods to achieve specific wetting properties on the surfaces. This, in turn will impact the adhesion between the impregnation resin and the coil constituents thereby potentially impacting the magnet's performance. Furthermore, these results will facilitate the development of predictive models for adhesion in superconducting magnets.

Submitters Country

Switzerland

Author: VERMA, Bharti (CERN)

Co-authors: PICCIN, Roland (CERN); AVILES SANTILLANA, Ignacio (CERN)

Presenter: PICCIN, Roland (CERN)

Session Classification: Tue-Po-1.4

Track Classification: Tracks ICMC Geneva 2024: ICMC 09: Insulation & Impregnation materials, processing and properties