DEVELOPMENT OF A FILLED RESIN SYSTEM FOR ASSEMBLY OF THE ITER TF COILS

D.E. Baynham[3], S.J. Canfer[1], G.E. Ellwood[1], D. Evans[4], S.H. Jones[1], J. Knaster[2], S.J. Robertson[1]

[1] STFC, Rutherford Appleton Laboratory, Didcot, Oxon. UK.
[2] ITER Organization, CS 90 046, 13067 St. Paul-Lez-Durance Cedex, France
[3]Magnetech Ltd, Didcot, Oxon, UK
[4]Advanced Cryogenic Materials Ltd, Abingdon, Oxon UK

Corresponding author:steve.robertson@stfc.ac.uk

The final step in assembly of the ITER TF Coils will be the insertion of the Winding Pack (WP) into the TF Coil structural casing followed by its mechanical location and final geometric definition. In order to facilitate mounting of the WP within the stainless steel casing structure the design is made with clearance gaps (~7-10mm) to allow for manufacturing tolerances and WP adjustment during mounting. However, it will be essential to fill these gaps efficiently as the last step of the insertion operation. This fill process is a critical part of the assembly operation; it completes the geometric location of the WP with respect to the casing and must provide for a uniform force transfer between the WP and Casing. The properties and specification of the filler material are therefore driven by these two requirements, the second being the more demanding.

It was considered that pre-filling the inter-space with dry glass fabric would present problems during assembly and would not provide a uniform material in a variable gap. Two other process options were therefore considered; direct fill by vacuum impregnation using a filled (charged) epoxy; or, pre-fill of the inter-space with dry particles (fibres, beads or powder) followed by vacuum impregnation with a low viscosity (unfilled) epoxy.

This paper reports results of trials using a low viscosity epoxy resin radiation stable to the design level of 10^{22} n/m^2 that is filled with wollastonite, dolomite or milled glass fibres. A key practical difficulty with the process is to minimise settling of the filler from the epoxy resin during filling / cure and results of settling trials are reported along with measured flow rates that are compared with theoretical predictions. Thermal analysis techniques to determine the optimum cure schedule for the resin are also outlined and thermal contraction and mechanical strength measurements at 77K are reported. Additionally, trials are reported using the same resin to impregnate, under vacuum, structures that have been pre-filled with various particulate mineral fillers.