MECHANICAL CHARACTERIZATION OF GLASS FIBRE-EPOXY COMPOSITE MATERIAL FOR ITER PRE-COMPRESSION RINGS

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Abstract

Pre-Compressions Rings have been designed to improve the ITER Magnets closure system.
They are made of high strength unidirectional S-2 glass fibers wound in an epoxy matrix.
In order to obtain very high strength properties ENEA developed and characterized this composite with an high volumetric glass content (~68%).
Benefits of this solution include high strength, no interference with magnet fields and long expected service life.
This work illustrates the mechanical characterization of the material used to manufacture the Rings.
At first linear specimens were produced to perform tensile and creep tests. Then reduced scale Ring mock-ups have been fabricated and tested in ENEA Fusion-Laboratories.
One ring was used for the machining of several specimens for compression and shear tests.
Standard and non standard specimens were realized from different geometric directions (longitudinal and transversal with reference to the fibre glass direction) and tested at room temperature and at liquid nitrogen (77K) temperature to complete characterization with compression and shear tests.
The experimental campaign has been carried out following as close as possible the related ASTM standards in order to evaluate material strength, Young and Shear moduli.
Test results showed high mechanical strength of the composite in fibre glass longitudinal direction, lower values in transversal direction and will supply the data for the stiffness matrix.