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P4.195 Stress-strain characterization of abs polymer at cryogenic temperatures

Thursday, 20 September 2018 11:00 (2 hours)

Plasma Laboratory for Fusion Energy and Applications at Instituto Tecnológico de Costa Rica (ITCR) plans the design of SCR-2; a Quasi-Toroidally Symmetric (QAS) two-field period modular Stellarator, aspect ratio ~5 formed by 24 modular magnetic coils. SCR-2 coils design is based on ESTELL QAS configuration (project cancelled) [1], supplied by Max Planck Institute for Plasma Physics, Greifswald, Germany.

Among SCR-2 design aspects, superconductive coils (SCC) and an additively manufactured (AM) coils structure stand out. These present engineering challenges, since high precision complex geometries [2][3] and cryogenic environment conditions must be complied at reasonable cost. Besides, AM research for magnetic confinement device construction is not yet a vast study field. Hence, this technique must be regarded for preliminary studies.

First, 77 K stress-strain (SS) tests on AM ABS specimens are carried out at ITCR, considering several manufacturing parameters. These parameters´ influence on the results obtained is analyzed using Design of Experiments methodology. In order to perform SS tests, a LN2 vessel adaptation for an universal testing machine was built. Tests description, results and SCR-2 concept models will be presented. Results from these experiments will be reckoned with so that FEM simulations of a prelusive design for the 3D printed modular coil structure could be performed.

[1] M. Drevlak et al., "ESTELL: A Quasi - Toroidally Symmetric Stellarator", Contrib. to Plasma Phys., vol. 53, no. 6, pp. 459 – 468, 2013.
[2] V.I. Vargas et al, Implementation of Stellarator of Costa Rica 1 SCR 1, in: 26th IEEE Symposium on Fusion Engineering (SOFE), 31 May – 4 June 2015, Austin, TX (USA), IEEE Conference Publications, 2016, pp. 1–6, ISBN: 978–1-4799–8264-6.
[3] V. Queral, "Prospects for Stellarators Based on Additive Manufacturing: Coil Frame Accuracy and Vacuum Vessels", IEEE Transactions on Plasma Science, issue 99, pp. 1-7, 2018.

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