

Development of physics/engineering design and
construction of quasi-axisymmetric stellarator CFQS

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The CFQS [1-3] is the world's first quasi-axisymmetric stellarator, and this project is being performed as the joint project of National Institute for Fusion Science in Japan, and Southwest Jiaotong University in China. The MHD equilibrium of the CFQS plasma was designed based on CHS-qa [4]. Major radius, magnetic field strength, aspect ratio, and toroidal periodic number of the CFQS are 1.0 m, 1.0 T, 4.0, and 2, respectively, and the engineering design study has been intensively advanced [5-8]. The main coil system is composed of 16 modular coils(MCs). For flexibility of magnetic field configuration, 12 toroidal field coils and 2 pairs of poloidal field coils are designed, of which detail is presented by S. Kinoshita, **8P42**. The electromagnetic force in CFQS is very strong due to compactness resulting from its low-aspect-ratio. For supporting structure, to withstand such strong electromagnetic force, partial coil cases, and cage like structure are employed. Finite element method (FEM) analysis has been done, and the results tell us that the stress on supporting structure is less than allowable level [5,6]. The 3D-shaped vacuum vessel (VV) was designed to keep good accessibility to plasma, and the FEM analysis was also performed to check the effect of stress caused by atmosphere pressure [7], and the eddy current produced during operation [8]. Those results show that the stress is less than the allowable level and does not lead to significant problem.

MCs are now being constructed by Hefei Keye Co., Ltd. in Hefei, China. For 12 MCs, 1st vacuum pressure

impregnation (VPI) process to fix conductor by resin has been already completed as shown in Fig.1. As for the VV, 1/4 toroidal section are under construction. Detail of VV is presented by S. Nakagawa, **7P41**. First plasma will be discharged on the condition of 0.1 T, and mapping experiment plan is presented by M. Shoji, **8P66**. In this paper, recent advances of CFQS physics/engineering studies and construction will be reported.

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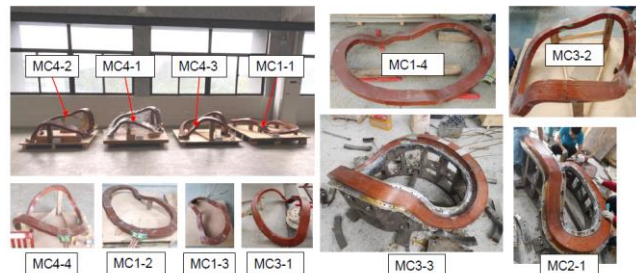


Fig.1 12 MCs after completion of 1st VPI.

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