Contribution ID: **731** Type: **not specified**

P2.160 The DEMO Helium Cooled Lithium Lead "Advanced-Plus" Breeding Blanket: design improvement and FEM studies

Tuesday, 18 September 2018 11:00 (2 hours)

In the framework of the European "HORIZON 2020" research program, the EUROfusion Consortium develops a design of a fusion demonstrator (DEMO). CEA-Saclay, with the support of Wigner-CR and IPP-CR, is in charge of one of the four Breeding Blanket (BB) concepts investigated in Europe for DEMO: the Helium Cooled Lithium Lead (HCLL) BB. The BB directly surrounding the plasma is a major component ensuring tritium self-sufficiency, shielding against neutrons from D-T plasmas and heat extraction for electricity conversion.
During the last few years, the HCLL BB design has evolved from a TBM-like concept, based on the Test Blanket Module for ITER, to a so-called "Advanced-Plus" concept in order to increase Tritium Breeding Ratio (TBR). This last concept, which is now the reference design for the DEMO HCLL BB, is characterized by the absence of vertical stiffening plates allowing a reduction of steel amount. The thermo-hydraulic scheme and mechanical design of the HCLL BB has been adapted to fulfill design criteria. Although previous studies were encouraging, they brought out some weak points in the design.
For this reason, this paper is particularly focused on the evolution of the HCLL "Advanced-Plus" BB design in order to improve the behavior of the structure. Thermal and mechanical Finite Element Method (FEM) calculations performed with Cast3M-FEM-qualified code on the equatorial outboard module are presented and analysed with RCC-MRx nuclear design and construction code for #1 accidental condition in case of Loss of Coolant Accident (LOCA) and #2 normal steady state condition. The methodology, the assumptions as well as the results obtained in each case are reported and critically analysed, scrutinizing some open issues.
Furthermore, a comparative study is made between the "Advanced-Plus"-reference concept and the TBM-like design to identify the advantages and drawbacks of each one regarding thermo-mechanical results.

Presenter: BOULLON, Rémi (Nuclear Energy Division CEA SACLAY)

Session Classification: P2