

Model Development and Electromagnetic Analysis of Vertical Displacement Event for CFETR Helium Cooled Solid Blanket

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As one of typical blanket concepts for Chinese Fusion Engineering Test Reactor (CFETR), a conceptual structure of helium cooled solid breeder (HCSB) blanket was designed by USTC. Considering that electromagnetic load is one of the main concerns for the blanket module, a FEM (finite element method) model of the HCSB was developed and the electromagnetic analysis of the blanket module was implemented using a finite element analysis (FEA) software called MAXWELL. For transient electromagnetic analysis with the vertical displacement event (VDE), a more accurate model where the plasma described by 69 filaments was adopted and the whole 15 blankets lying in a toroidal-poloidal section were explored. The research of the ferromagnetic effect of RAFM steel was carried out and the magnetic field, induced eddy currents, the magnetic force were computed and analyzed. The analysis results show that ferromagnetic effect broadened the range of magnetic field of the model and strengthened eddy current effects. In addition, the maximum value of the eddy current density was 71.2 MA/m² and the maximum magnitude of the electromagnetic forces was 1409.0 kN under the ferromagnetic effect.

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Primary author: Prof. CHEN, Hongli (University of Science and Technology of China)

Co-authors: Mr CHENG, Jin (University of Science and Technology of China); Ms XU, Qingqing (University of Science and Technology of China)

Presenter: Prof. CHEN, Hongli (University of Science and Technology of China)

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