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Simulation of heat flux during ELMs for the CFETR hybrid scenario using BOUT++ framework

Z P Liu[1], Z H Wang[2], W X Tian[1], X Q Xu[4], T Y Xia[3], J L Chen[3]
[1]Xi'an Jiaotong University, Xi'an China, [2]Southwestern Institute of Physics, Chengdu, China, [3]Institute of Plasma Physics Chinese Academy of Science, Hefei, China, [4]Lawrence Livermore National Laboratory, Livermore, USA
email: 18571502065@163.com

Considering plasma facing materials could be destroyed because of the high heat and particles flux during ELMs, it is necessary to find out if the first wall can survive this process. Much work about heat flux in SOL for TOKAMKs has been done before. For CFETR, which has been put forward to complement the ITER facility, aiming to demonstrate fusion energy production up to 200MW initially and to eventually reach DEMO relevant power level, the plasma components interaction will be more serious in it. And the perpendicular heat flux, derived from the radial component of $E \times B$ drift named as the convective component and of the perturbed magnetic flutter in the parallel energy flux called the conductive component, cannot be neglected as before. In this paper, the simulation under BOUT++ framework for the self-consistent hybrid mode scenarios for CFETR has been done. A six-field two-fluid model based on the Braginskii equations with non-ideal physics effects is used to calculate the particle and heat fluxes during burst of ELMs on CFETR. The linear analysis is conducted to determines the characteristic of the ELM. In the ELM nonlinear process, the turbulent particle and heat transport due to ELM is calculated. The ELM size, heat flux width and radical heat flux distribution are also found out in this paper. And the comparison will be made to find the differences between the simulations of ELMs on CFETR and other TOKAMAKs. The results in this paper are important for the next safety analysis of the CFETR first wall.

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