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INVESTIGATION OF HEAT FLUX ON THE DIVERTOR PLATE SURFACE WITH FAST RESPONSE THERMOCOUPLES IN EAST TOKAMAK *)

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The control of plasma-facing surface heat fluxes is one of the key issues for magnetic fusion devices. When the heat and particle flux is above the damage threshold for the plasma-facing materials, the lifetime of the first wall will reduce due to erosion, sputtering and cracking of its surface. To obtain experimental data about the physics of heat transport in the boundary plasma and prevent the high surface temperature of plasma-facing components, reliable diagnostics for heat flux measurements are essential [1]. In [2], it is proposed to use a surface eroding thermocouples (SETC) system to surface temperature of the divertor plate, an area outside the field of view of IR cameras. The thermocouples are made of tungsten and rhenium; thus, they have a large measurement range up to 2300 degree centigrade. At the same time, it is possible to obtain fast temperature measurements using thermocouples.

The SETC system has been installed on the divertor target plate since 2022 EAST autumn experimental campaign. The system includes four channels of SETC sensors installed in the vertical target plate of the lower outer tungsten divertor in EAST. The distance between thermocouples is 1 centimeter. This system now is able to measure the divertor surface temperature evolution during EAST long-pulse plasma operation and fast transient events, such as the large-amplitude Edge-Localized Mode bursts in tokamak edge plasma.

The report presents the results of the surface temperature dynamics research of the EAST's divertor plate obtained using the SETC system. In addition, the calculation results the dynamics of the heat flux absorbed by the plasma-facing element are presented. The heat flux was obtained by solving the inverse problem of thermal conductivity based on the SETC temperature measurement for a three-dimensional element with specific geometric parameters.

References

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