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P2.110 Thermal properties of stabilized jets for the liquid metal divertor REVOLVER-D

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The thermal property of the jet stabilized by an internal flow resistance has been investigated in order to apply the liquid metal divertor consisting of molten tin shower jets named the REVOLVER-D, to the helical fusion reactor, FFHR. The allowable heat load on the REVOLVER-D is higher than that of conventional solid divertors. The droplet formation of the jet can be avoided by inserting an internal flow resistance like chains or wires. On the other hand, the vapor from liquid metal can deteriorate the core plasma performance. The temperature of tin must be kept less than 1000 K to suppress the vapor pressure less than 10-5 Pa although the vapor pressure of molten tin is lower than that of other metals. The temperature increase of jets can be suppressed if the fluid is uniformly mixed. However, jets have temperature distribution and the peak temperature can exceed 1000 K. The thermal property needs to be investigated to control the temperature of molten tin jets. Therefore, experiments with the U-alloy78 circulation device and numerical simulations with ANSYS have been carried out. U-alloy78, an alloy of tin, bismuth, and indium is selected as the working fluid instead of molten tin because of low melting temperature. The density, dynamic viscosity, and specific heat of U-alloy78 are similar to those of molten tin. The effect of heat transfer enhancement by the turbulence generated by the internal flow resistance is also investigated. The dependence of the thermal property of the jet on the shape and size of the internal flow resistance will be given in this presentation.

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