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Integrated core-SOL-divertor modelling for DTT tokamak with liquid metal divertor targets

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The behaviour of the SOL plasma of the Italian projected DTT is analysed for the standard divertor configuration by means of the integrated COREDIV code simulations when either Lithium or Tin are used as liquid target materials.
The DTT tokamak is expected to operate in H-mode, which requires the value of power to scrape-off layer above the L-H threshold. On the other hand it is postulated that the divertor power load should be controlled to not exceed 5MW/m2. Cooling of the plasma can be achieved by seeding or by intrinsic impurities like particles released from the divertor. In the case of liquid metal divertor, vaporization additionally enhances the plate material flux into the bulk.
This paper analyses possible operational space for DTT device with liquid Sn or Li divertor setup. The impurities originating from the sputtering and vaporization processes are expected to modify plasma characteristics significantly both in the bulk and in the scrape-off layer. Therefore, simulations are performed with COREDIV code which self-consistently solves radial 1D energy and particle transport equations of plasma and impurities in the core region and 2D multifluid transport in the SOL.
Density and power scans are carried out for different target arrangements, in terms of the coolant temperature and thickness of W substrate. First scenarios with only intrinsic impurity are investigated. Tin appears more promising of lithium in terms of radiative capacity, of wider ranges of applicability both of density and input power and of plasma purity. No clear detachment is observed for either Sn or Li except at very high density. For both solutions regime where evaporation overcomes sputtering is more effective in dissipating the input power, provided that is kept low enough to ensure plasma stability. In this case a sort of vapour shielding seems to develop attached to the impurity source.

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