CONCAVE LIQUID METAL DIVERTOR FOR SPHERICAL TOKAMAKS

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Several new innovative ideas are being considered for tokamak divertors in magnetic fusion devices. One of such concepts is the use of liquid metals as the plasma-facing component. One of main problem for the use of liquid metal divertors is the MHD problem associated with a liquid metal being in the strong tokamak magnetic field. This is particularly important for the conventional tokamaks such as ITER and DEMO that have relatively large aspect ratio. As a result, the magnetic filed lines have small inclination angle to the divertor plate, thus liquid metal flows practically normally to magnetic field and therefore, results in many problems with MHD features (Pressure drops, JxB splashing effects, etc.). The second problem is related to helium and particle pumping due to high diffusivity of gas in liquid metal. For current existing design concepts of large tokamak aspect ratios, artificially excited fluctuations are needed for sufficient pumping. In this study the possibility of avoiding these problems are considered for spherical tokamaks such as NSTX. Due to small aspect ratio, the inclination of magnetic filed lines nearby the separatrix to the divertor plate is much larger (about 200 or higher). This will permit to use liquid metal flow moving along magnetic filed lines in space-concaved trays. Flow parallel to magnetic field lines has no pressure drop except some (small) influence nearby the trays walls. Excitation of the Taylor-Couette vortexes instabilities make possible to sink of He particles deeper in bulk due to liquid metal rotation along velocity direction parallel to magnetic field lines.