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Development and Testing of a High-Density Tungsten Alloy Liquid Metal Divertor for Fusion Devices

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The Tokamak Divertor serves as a critical component within fusion reactors, essential for managing plasma exhaust and ensuring the stability and efficiency of nuclear fusion devices. It effectively remove and contain particles such as helium ash, fuel impurities and heat-dissipating particles, thereby enhancing plasma stability and extending reactor lifespan. A Tungsten base alloy divertor having, 95% Tungsten and the remaining 5% are Ni & Fe has been fabricated by using powder metallurgy technique. The divertor geometry consists of seven parts, which are joined together to form a single module. The central four parts are designed in a way to form a cavity for the storage and supply of liquid lithium during operation. The texturing on the surface of alloy for the formation of wicking channels has been performed by using wire electrode discharge machining (EDM) to form a pourus capillaries to enhance the flow of liquid lithium for heat removal. The SEM and XRD of the machined samples are performed to study the roughness, cracks and phase changes at the surface after EDM machining. The same design has already been used and tested by "Magnum-PSI"for Titanium zirconium molybdenum alloy. Tantalum heater has been used for heating i.e. rising the temperature of the divertor. The heat removal efficiency of the flowing liquid metal i.e. lithium through the wicking channels has been studied.

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