

## **STRUCTURED POROUS MEDIA FOR HIGH HEAT FLUX FUSION APPLICATIONS**

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Effective heat transfer is essential for fusion power core components in order to enable the maximum possible power density and power conversion efficiency needed for economic competitiveness and fuel conservation. Helium coolant is particularly attractive for fusion power plant applications due to its inherent safety features. It can be used in conjunction with a refractory metal such as tungsten for high temperature operation. However, application of helium as coolant for plasma facing components is limited by its rather modest heat transfer performance. The use of structured porous media is a proposed technique to achieve higher heat transfer coefficients by increasing the specific surface area for heat transfer while aiming to maintain acceptable pressure drop and pumping power. The general design strategy is to minimize the coolant flow path through the porous medium while optimizing the porous medium characteristics to minimize the friction pressure drop for a given heat transfer performance.

A comprehensive thermo-fluid model called MERLOT has been developed to calculate the velocity profile for a given pressure drop and the corresponding temperature distribution in a porous region with the capability to account for variation in the porous medium microstructure and to include potentially important processes such as the local heat transfer between solid and fluid and the effect of dispersion. MERLOT was used to assess the use of porous heat transfer media for fusion plasma facing component applications. A parametric study was performed to assess the relative importance on the heat transfer performance of key design parameters including the solid conductivity, the porosity magnitude and distribution, the microstructure characteristic dimension, and the local heat transfer coefficient. The analysis was carried out for different incident heat fluxes of up to 30 MW/m<sup>2</sup> with the goal of identifying particularly attractive sets of design parameters for plasma facing components.

Divertors and plasma facing components

Poster Preferred

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