Development and Characterisation of Reference Tungsten, Tungsten alloys and SiC_f/SiC for DEMO Fusion Applications

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Introduction

The presented work is a summary of the first results obtained on Tungsten / Tungsten alloys and SiC_f/SiC composites, considered as potential structural / armour materials for the He cooled divertor in the future DEMO fusion reactor. The research is performed within the frame of European Fusion Development Agreement (EFDA) programme.



MIM W/W alloys: homogeneous and clean materials with grain sizes of several µm
Density values: 95-97%
Constitute 25-97%

• ODS materials show regularly distributed Yttria particles: usually very fine (-nm); 5% Y2O3 material exhibits fairly larger porosity

Thermal conductivity: similar for 1% Y_2O_3 & Ref. W; fairly lower conductivity: – 10W/mK for 5% Y_2O_3 • In terms of bending strengths: ODS materials are stronger in comparison to the Ref. W

Ref. W shows very high tensile strengths at T>300°C; at 200°C the material is brittle.

- 3D SiC/SiC material offers better physical properties in comparison to the 2D material
- 2D SiC/SiC material seems to be stronger than the 3D SiC/SiC: higher tensile and bending strengths
- Cracks are mostly propagating in the fiber-matrix interface, but also 'through-fiber' mechanism is often observed
- Significant porosity observed in the bended specimens (more distinct for 3D SiC,SiC material)
 - · 'Fiber pull-out' mechanism observed in the tensile specimens