Contribution ID: **468** Type: **not specified**

P4.132 Production of tungstenfibre reinforced tungsten composite by a novel continuous chemical vapour deposition process

Thursday, 20 September 2018 11:00 (2 hours)

For the use in a fusion reactor, tungsten has unique properties such as a high melting point, low sputter yield and hydrogen retention as well as moderate activation. The brittleness below the ductile-to-brittle transition temperature and the embrittlement during operation are the main drawbacks for the use of pure tungsten in plasma facing components. Tungsten fibre-reinforced tungsten composites overcome this problem by utilizing extrinsic mechanisms to improve the toughness. Dense samples (>99%) with the size of 50x50x3 mm^3 incorporating nine layers of tungsten fibre fabrics have been successfully produced by layer wise chemical deposition, where tungsten is deposited on hot surfaces from gaseous precursors on fibre preforms. The sequential deposition process with intermediate vents for the fibre placement could lead to internal interfaces in the tungsten matrix due to surface oxidation. Despite this caveat, small specimens for mechanical testing could be fabricated from the samples, which revealed the expected improved fracture toughness. The next step in the material development is the production of larger components and testing under cyclic high heat flux loading. A dense matrix produced with a reliable production routine is one of the major issues for the production of such components. A novel continuous deposition process was introduced by designing and testing a set up For Rotary Enhanced Deposition (FRED) in the already existing W InfiLtration MAchine (WILMA), fabricating first samples. These samples were examined by microstructural analysis and compared to material produced by the standard technique. It is shown that this advanced set up in combination with tungsten fabrics allows the productions of tungsten-fibre reinforced tungsten composite in a considerably faster and more defined way.

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Session Classification: P4