POWDER INJECTION MOLDING - AN INNOVATIVE MANUFACTURING METHOD FOR HE-COOLED DEMO DIVERTOR COMPONENTS

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At Karlsruhe Institute of Technology (KIT), a He-cooled divertor design for future fusion power plants has been developed. This concept is based on the use of modular cooling fingers made from tungsten and tungsten alloy [1], which are presently considered the most promising divertor materials to withstand the specified heat load of 10 MW/m^2. Since a large number of the finger modules (n > 250,000) are needed for the whole reactor, developing a mass-oriented manufacturing method is indispensable. In this regard, an innovative manufacturing technology, Powder Injection Molding (PIM), has been developed at KIT since a couple of years. This production method is deemed promising in view of large-scale production of tungsten parts with high near-net-shape precision [2], hence, offering an advantage of cost-saving process compared to conventional machining.

This paper describes the complete technological PIM process for tungsten materials and its application on manufacturing of real divertor components. Results of the first application on tungsten tile manufacturing in this way, including some post-examinations as part of characterization to be compared with results gained by conventional machining, shall be discussed.

[1] P. Norajitra, et al., Helium-cooled divertor for DEMO: Manufacture and high heat flux tests of tungsten-based mock-ups. J. Nucl. Mater. 386-388 (2009) 813-816.

[2] S. Antusch, et al., Powder Injection Molding for mass production of He-cooled divertor parts. J. Nucl. Mater. (2010) submitted.