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TWO COMPONENT TUNGSTEN POWDER INJECTION MOLDING – AN EFFECTIVE MASS PRODUCTION PROCESS

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Tungsten and tungsten-alloys are presently considered to be the most promising materials for Plasma Facing Components for future fusion power plants. The Karlsruhe Institute of Technology (KIT) divertor design concept for the future DEMO power plant is based on modular He-cooled finger units. Each 1-Finger module consists of many single parts e.g. the tungsten tile and the tungsten alloy thimble, for the whole divertor system more than 250,000 single parts are needed.

The advantages of tungsten and tungsten alloys are the high melting point, low activation, low erosion rate and high thermal conductivity. But the brittleness and hardness of these materials make the fabrication by mechanical machining such as turning and milling very difficult, time and cost intensive. Therefore, the development of suitable mass production methods for divertor parts was needed.

A time and cost effective near-net-shape forming process with the advantage of shape complexity, material utilization and high final density is Powder Injection Molding (PIM). This process was adapted and developed at KIT for tungsten and promising results have already been achieved. Two component tungsten powder injection molding as further development allows the joining of two different materials e.g. tungsten with a doped tungsten alloy, without brazing.

This contribution describes the complete technological process of two component powder injection molding for tungsten materials and its application on producing real DEMO divertor parts. Characterization results of the finished parts e.g. microstructure, hardness, density and joining zone quality are discussed.

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