



PROTECTION LAYERS OF TUNGSTEN FOR HIGH TEMPERATURE APPLICATIONS

Task

On account of its high melting temperature and high density, tungsten is an excellent material for protection against wear, corrosion and radiation at high temperatures. For reasons of cost and its poor machinability, however, tungsten is seldom used as a solid material; thus, coating with tungsten can serve as an alternative. In cooperation with the INR (Institute for Neutron Physics and Reactor Technology) of the Karlsruhe Institute of Technology, Fraunhofer ILT has set itself the goal of adapting Laser Metal Deposition (LMD) to produce pore- and crack-free layers of pure tungsten onto a steel material.

Method

A 3 kW diode laser is used as the beam source for LMD. Tungsten is fed into the process in powder form through a coaxial powder nozzle. To reduce the formation of cracks, the substrate is preheated to a temperature of about 330 °C.

Result

LMD can be used to generate pore- and crack-free tungsten layers with thicknesses of up to one millimeter. Due to the large melting point difference, a significant portion of the substrate material is melted. Through multi-layer coating, however, it is already possible to tune a tungsten content of up to 85 percent by weight in the layer with a constant parameter set. The layers are currently being tested at the INR. From further investigations, the research partners expect to be able to reduce the dilution of the substrate by adjusting the process parameters of the multilayer structure even further.

Applications

The process could be used in a fusion reactor; tungsten layers could increase the lifetime of the »first wall« during helium bombardment. Other potential fields where this technology can be applied are, for example, in the high-voltage current sector or plasma technology.

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3 SEM micrograph of a tungsten layer
with 200-fold magnification.