PLATH00011

HEA THIN FILMS AS PROTECTIVE BARRIER AGAINST CARBON DIFFUSION DURING SPS.

■ DEPOS - PLASMA-ASSISTED DEPOSITION, COATINGS AND LAYERS

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Abstract content

The production of metal parts by powder metallurgy using the Spark Plasma Sintering (SPS) process, results in a fine and homogeneous microstructure with a chemical composition close to that of the initial powder. In this process, the sintering is performed by the simultaneous application of a pulsed current, making it possible to heat the powder, and of a uniaxial pressure. The powder is isolated from direct contact with the graphite tooling (mould, punches) by a sheet of graphite.

A major drawback of this process, in the case of the sintering of metallic powders, is carbon contamination, which leads to the formation of highly carburized layers on the surface or even to the diffusion of carbon at the grain boundaries deeper in the part. In a previous study, the effectiveness of a titanium coating, deposited by magnetron sputtering onto the graphite sheet, as a carbon diffusion barrier during the sintering of pure iron, was demonstrated [1].

In this work, the potential of HEA thin films as a carbon diffusion barrier is investigated. A Ti-Ta-Zr-Hf-W equimolar target (8” in diameter) is used in pure argon and argon- nitrogen mixture atmospheres to deposit a 2 µm thick coating on graphite sheets, glass, and silicon. The coated graphite sheets are used in the sintering of iron powder, while the other samples are analyzed for film characterization (XRD, SEM, EDS). Compared to the previously tested films, the HEA thin films presents the best behavior as diffusion barrier and as antisticking coating.

Thanks/Acknowledgement

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References

[1] M.R. Ardigo-Besnard et al., Solids 2(4) (2021) 395-406.

Sintered iron sample with the coated carbon foil