



#PLATH00030

GROM / Thin films growth and modelling

High temperature oxidation resistance of metallic materials by PVD coatings: influence of the initial substrate roughness

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Abstract content

The application of a coating to the surface of metallic materials can improve some properties, such as high temperature (800-1000 °C) resistance. The preparation of the substrate and its initial surface state play a major role in the continuity and conformity of the deposited PVD layer. Long open porosities can be present and will affect diffusion phenomena, leading to a loss of the high temperature protective properties of the PVD layer. In this study, steel substrates were prepared with different surface finishing grades from grinding to mirror polishing. They were then coated by sputtering and finally oxidized at high temperature. Surface topography and cross section morphology analyses were performed by optical profiler and SEM on the bare substrates, after coating and after oxidation. In order to understand the role of the surface morphologies PVD simulation are performed with SIMTRA [1] for the transport and NASCAM [2] for the growth.

References

[1] K. Van Aeken, S. Mahieu, D. Depla, The metal flux from a rotating cylindrical magnetron: a Monte Carlo simulation, J. Phys D.: Appl. Phys. 41 (2010) 205307

[2] R. Tonneau, P. Moskovkin, A. Pflug, S. Lucas, TiO_x deposited by magnetron sputtering: a joint modelling and experimental study, J. Phys. D.: Appl. Phys. 51 (2018) 195202