Coatings for Use at High Temperatures
Room Golden State Ballroom - Session AP-ThP

Coatings for Use at High Temperatures (Symposium A) Poster Session

AP-ThP-2 Corrosion Induced Diffusion Pathways in Pvd $Al_{1-X}Cr_XN$ Coatings Investigated by Atom Probe Tomography, ***Oliver Ernst Hudak (oliver.hudak@tuwien.ac.at),*** Christian Doppler Laboratory for Surface Engineering of high-performance Components, TU Wien, Austria*; T. Wojcik,* Christian Doppler Laboratory for Surface Engineering of high-performance Components, TU Wien , Austria*; V. Dalbauer,* Department of Materials Science, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*; L. Shang, M. Arndt, O. Hunold,* Oerlikon Balzers, Oerlikon Surface Solutions AG, 9496 Balzers, Liechtenstein*; P. Polcik,* Plansee Composite Materials GmbH, D-86983 Lechbruck am See, Germany*; P. Felfer,* Department of Materials Science, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*; H. Riedl,* Christian Doppler Laboratory for Surface Engineering of high-performance Components, TU Wien, Austria

Corrosion processes are common phenomena in fields of engineering and there is nearly never an instance, where a material is totally inert to its environment. Therefore, corrosion and corrosion-resistance are essential variables that play a pivotal role in the development of protective coatings. Ingenuity of next generation PVD coatings has given rise to a wide range of material concepts set out to withstand all kinds of corrosive attacks (e.g. NaCl, HCl, SO_3 and O_2). While their performance is mostly assessed on descriptors such as mass change, impairment of mechanical properties, or variance in electrochemical surface potential, little work has been dedicated to understand corrosion driven diffusion pathways, specifically on an atomic scale.

Particularly the production of metallic-spits or “droplets” during PVD processes poses a significant drawback in light of the coating’s corrosion resistive capabilities. In many regards, embedded macro particles, logged within the deposited coating matrix, serve a beneficial cause, when it comes to improved mechanical properties, such as hardness, fatigue resistance and fracture toughness. However, in light of corrosion behavior, macro-particles provide formations of voids and rugged grain boundaries that allow for fast-track diffusion of corrosive media to the substrate-coating interface.

This study showcases a systematic approach on highlighting preferred diffusion pathways of corrosive NaCl-rich media in PVD thin films. Intended as a model system, arc-evaporated- as well as sputtered AlCrN coatings were deposited on low alloy steel substrates and electrochemically investigated using a three-electrode set-up. With a Ag/AgCl reference electrode (RE), a Pt-counter electrode (CE) and the coated-steel sample as working electrode (WE), linear potentiodynamic polarization experiments were conducted in a 1M NaCl solution.

Next to SEM investigations, high resolution analytical techniques such as APT and TEM were consulted to help identify preferential diffusion paths, and highlight differences in the corrosion behavior of arced- and sputtered coatings.

Keywords: Corrosion Resistance; PVD coatings; Diffusion Pathways; Atom Probe Tomography

AP-ThP-8 Microstructure and Oxidation Behaviour of $MoSi_2$ Thin Films Grown by DCMS and HiPIMS, ***Ahmed Bahr (ahmed.bahr@tuwien.ac.at),*** *S. Richter, T. Wojcik,* Christian Doppler Laboratory for Surface Engineering of high-performance Components, TU Wien , Austria*; J. Ramm, O. Hunold,* Oerlikon Balzers, Oerlikon Surface Solutions AG, Liechtenstein*; S. Kolozsvári,* Plansee Composite Materials GmbH , Germany*; H. Riedl,* Christian Doppler Laboratory for Surface Engineering of high-performance Components, TU Wien , Austria

Refractory transition-metal disilicides ($TMSi_2$) can be considered as promising candidates to be applied as protective coatings in high temperature applications as they have attractive combined properties such as high melting point, acceptable mechanical properties and especially high oxidation resistance in air.$MoSi_2$ exhibits an attractive mix of good mechanical properties and outstanding high temperature oxidation resistance due to the formation of a protective silicon-based oxide.

In our study, we employed direct current magnetron sputtering (DCMS) and High-power magnetron sputtering (HiPIMS) techniques to synthesize $MoSi_2$ thin films. We investigated the influence of the deposition parameters on the phase formation and the mechanical properties of the films. Moreover, the oxidation kinetics were analyzed at different temperature regimes up to 1500 °C. The coatings were characterized in terms of chemical composition, phase constitution, and mechanical properties using high-resolution characterization techniques.

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