Hard Coatings and Vapor Deposition Technologies
Room Town & Country D - Session B4-4-TuA

Properties and Characterization of Hard Coatings and Surfaces IV

Moderators: Naureen Ghafoor, Linköping University, Sweden, **Johan Nyman**, Linköping Univ., IFM, Thin Film Physics Div., Sweden, **Justinas Palisaitis**, Linköping Univ., IFM, Thin Film Physics Div., Sweden

4:40pm **B4-4-TuA-10 Synthesis by CVD and Properties of Polycrystalline Silicon Coatings for Structural Applications***, **Axel Le Doze (ledoze@lcts.u-bordeaux.fr)**, G. Couégnat, J. Danet, F. Rebillat, G. Chollon,* LCTS, CNRS, Univ. Bordeaux, CEA, SAFRAN CERAMICS, France

Environmental barrier coatings (EBCs) are used to limit the oxidation/corrosion of ceramic matrix composites. The silicon bond coat (BC) is a key component of the EBC system. In use, the silicon BC oxidizes to form a silica layer (TGO) at the EBC/BC interface. For high temperature applications, excessive creep may lead to unacceptable deformation of the system and impede its use as coating for rotating parts with high centrifugal loads. It is therefore crucial to control the creep behavior of the BC. Currently developed by plasma spraying, the silicon BC is composed of micrometric grains. Tailoring the silicon microstructure could be an efficient way to adjust the creep behavior of the BC. Chemical vapor deposition (CVD) is a process that allows the coating microstructure to be varied.

In this work, the CVD of polycrystalline silicon from $SiHCl_3/H_2$ was explored in details and a selection of coatings were prepared on various substrates for testing. A microbalance and FTIR spectrometer were coupled to the reactor to monitor deposition kinetics and the composition of the exhaust gas. The morphology and microstructure of the deposits were investigated by SEM (grain size, surface roughness) and EBSD (grain size and orientation, texture), and the creep properties by high temperature flexural tests (3-point bending). The oxidation/corrosion kinetics of the deposits were also evaluated *post mortem* after annealing in a corrosion furnace at controlled H_2O pressure and gas flow.

Several microstructures were obtained by varying the CVD conditions (temperature, pressure, total gas flow, $H_2/SiHCl_3$ ratio) and thermal annealing. Distinctive responses of the silicon coatings to mechanical stresses have been measured, illustrating different deformation mechanisms (intra-granular dislocations, diffusion at grain boundaries). This work confirms that the creep behavior of polycrystalline silicon is strongly dependent on the microstructure (grain size/orientation, nature and proportion of grain boundaries). The oxidation/corrosion tests show that oxidation kinetics are relatively independent of the microstructure.

In conclusion, a wide variety of microstructures can be obtained by CVD and thermal annealing. They result in creep behavior that can vary considerably, but similar corrosion rate. The thermomechanical properties of CVD Si can be readily modulated without compromising its corrosion resistance.

5:00pm **B4-4-TuA-11 Erosion Resistance of Thin Films Under Solid Particle Flows and Temperature***, **Kai Treutler (treutler@isaf.tu-clausthal.de)**, J. Hamje,* Clausthal University of Technology, Germany*; T. Bick,* Clausthal University of Technology, Clausthal, Germany*; V. Wesling,* Clausthal University of Technology, Germany

Components such as turbine blades are often provided with protective coatings to protect them from wear. These are usually ceramic or metallic coatings that can be applied using the PVD process, for example. While hard ceramic coatings are very effective for sliding wear, soft coatings with a metallic character are better for impact wear. The aim of the investigations presented is the characterization of metallic-ceramic coatings under particle jet wear at elevated temperatures. The presented coatings offer the advantage that they can be converted to a ceramic state with the aid of heat treatment. If the heat treatment is carried out by means of a laser beam, the coating properties can be influenced locally and adapted according to the stress. The wear behaviour of f.e. Ti-Si-C and Ti-Si-B coating systems will be presented below at angles of incidence of 30°, 45° and 60° and an abrasive mass flow rate of 9 g/min. For this purpose, the surfaces were irradiated at room temperature and 200°C with a mixture of clay dust and quartz powder, and the abrasion was determined gravimetrically.

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