DEVELOPMENT OF EBCS AND T/EBC MULTI-LAYER COATINGS: CHALLENGES AND IMPLICATIONS

Ravisankar Naraparaju, German Aerospace Center, Cologne, Germany
Ravisankar.naraparaju@dlr.de
Uwe Schulz, German Aerospace Center, Cologne, Germany
Vito Leisner, German Aerospace Center, Cologne, Germany
Ronja Anton, German Aerospace Center, Cologne, Germany
Alexandra Rose, German Aerospace Center, Cologne, Germany
Zachary Stein, German Aerospace Center, Cologne, Germany
Christoph Mikulla, German Aerospace Center, Cologne, Germany

Environmental barrier coatings (EBCs) must protect the underlying ceramic matrix composites (CMCs) based on SiC-SiCf against steam enhanced oxidation and against severe surface recession. In this presentation, multilayer EBCs manufacturing by PVD methods such as magnetron sputtering and EB-PVD on SiC-based CMCs will be discussed. The magnetron sputter deposition of an oxide-modified silicon bond coat, an intermediate layer of a rare-earth di-silicate, and a top layer of mono-silicate and the stability/life-time of the entire system will be discussed. The challenges of EB-PVD methodology in producing EBCs will be addressed and some preliminary results will be presented. As CaO-MgO-Al_2O_3- SiO_2 (CMAS) is a well-known threat to the EBC functionality, an additional CMAS resistant top layer is necessary which adds more complexity to the multi-layer system. A multi-phase CMAS resistant coating containing Y-Fe-Si oxides has been developed and its applicability on a state-of-the art EBC system will be demonstrated and the CMAS infiltration results at high temperature will be presented.

Second part of the work presents the idea of using novel Thermal and Environmental Barrier Coating (T/EBCs) systems containing top layers such as GZO and 65YZ so that CMCs can work at even higher temperatures. The major challenges such as attaining right microstructures, CMAS resistance as well as erosion resistance of these T/EBC systems will be thoroughly discussed.