THERMALLY SPRAYED PROTECTIVE COATINGS UNDER DEMANDING LOAD CONDITIONS

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Materials in turbines are facing increasingly demanding conditions under operation. This is due to their diversifying field of application as e.g. in interplay with renewable energy sources. Each set of loading conditions, in terms of e.g. operation temperature, start/stop-frequency or contaminants present in the combustion atmosphere, shows a specific footprint of degradation pathways. Understanding and performance data are available for many individual degradation footprints as to date materials and coatings are developed in respect to each one of that kind of loading scenarios. Less often, materials are assessed at a wider range of conditions where changes and interplay of degradation modes can be observed.

Today's demand for design of material systems for flexible or volatile conditions of operation requires to consider the wider range of operation regimes including complex sequences of loading phases adding up to the overall degradation. Performance and degradation modes of APS TBC systems (both single layer YSZ as well as a double layer of YSZ plus $Gd_2Zr_2O_7$) were studied under various conditions in cyclic testing. This includes scenarios with isothermal and gradient testing as well as sequential vs simultaneous loading with CMAS. Results are evaluated with respect to changes of (coexisting) degradation modes and spallation lifetime. Applicability of some modeling tools is discussed for lifetime prediction.