

NON-OXIDE CERAMIC MATRIX COMPOSITES FOR APPLICATION IN HOT GAS ATMOSPHERES – REQUIREMENTS AND POTENTIAL

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In spite of the ambitious efforts to increase the portion of alternative and renewable resources the energy production based on fossil fuels will still represent the main part of energy in the next years. Caused by the increasing energy price and the stronger requirements in environmental protection the main focus of future generations of gas turbines will be emphasized on an increased efficiency with a simultaneous reduction of the emissions. From technical point of view these goals can be obtained only by higher hot gas temperatures. Ceramic matrix composites (CMC) offer a high potential for applications as structural parts in advanced gas turbines. During recent years, significant progress in material development of oxide and non-oxide CMC has been achieved, however, there are still considerable deficits especially in the long-term behavior of the materials in hot gas conditions.

The present study is focused on the environmental stability of the materials. Caused by the high water vapor pressure in combination with high temperatures and gas velocities, corrosion processes at the surface and inside the materials were observed resulting in significant material degradation and mass loss. Hence, environmental barrier coatings (EBC) have been presented to be the solution to protect the surface of the ceramic materials.

Systematic studies on the hot gas corrosion of non-oxide CMC have been performed with and without EBC. Based on a detailed understanding of the processes in the whole system, EBC and the ceramic base material during application in hot gas environments at elevated temperatures, general concepts for the development of environmental barrier coatings will be discussed.