"Novel Method for the Evaluation of Ultra High Temperature CMCs applied in Orbital and Airbreathing Propulsion"

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One requirement on materials for combustion chambers of orbital thrusters, as well as propulsion components of dual-mode ramjets is the ability to withstand high aerodynamic, thermo-mechanical and thermo-chemical loads during operation. To obtain higher combustion efficiency and thus higher performance, higher combustion temperatures resulting in higher material working temperatures (up to 1600 to 1900°C) have to be verified. In addition to the extreme combustion temperatures the harsh propulsion environment which includes severe thermo-chemical interactions between the combustion products and the substrate has to be mastered. Such demanding requirements limit the field of possible materials to ultra-high-temperature ceramics and coating systems like. CMCs (C/SiC, C/C-SiC) with suitable coatings system (β-SiC, HfC, ZrB_2 and HfB_2).

Investigating and validating propulsion relevant materials is usually tedious and expensive. Testing the typical influence factors on combustion components, like temperature, pressure, hot gas velocity and chemistry, is executed on full- scale- or sub-scale level and therefore generates high effort and high costs. In order to keep development expenses to a minimum, it is of utmost importance to have a fast, reliable and inexpensive way of material screening. The **E**nvironmental **R**elevant **B**urner **R**ig-**K**erosene (ERBURIG^K) facility is set up to achieve a fast material screening and to investigate the material behaviour in combustion chamber-like environments. Materials can be tested on flat specimen level in a wide temperature range, in oxidizing and reducing atmospheres at high gas velocities, and in different chemistries to assess their suitability for combustion chamber relevant environments. Furthermore tests with coated composite micro combustion chambers and ramjet components will cover the geometrical influence.