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Tubular Composite Reinforcements

Mein Zeichen: Kot
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Project title:	AllOxITD - Development and Manufacturing of an All-Oxide Inter Turbine Duct for Aero engines
Partners:	Deutsches Zentrum für Luft und Raumfahrt e.V., Schunk Kohlenstoff-Technik GmbH
Project period:	12/2015 – 05/2020
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Mission Statement

Ceramic Matrix Composite materials (CMCs) have excellent properties at high temperatures. In contrast to metallic materials they do not lose in strength up to 1000°C. This behavior is making CMCs interesting for components in the hot gas section of gas turbines. Due to higher allowable material temperatures the effort for cooling air can be significantly reduced in contrast to metallic components. This is increasing the turbine efficiency by using as much air as possible for the thrust-producing main flow direction. The objective of the project is the development of an all-oxide Ceramic Matrix Composites (CMC) inter turbine duct for testing in a demonstrator engine.

Approach:

The development process is featured by the following steps:

- Designing the parts including the attachment to the metallic support structure
- Defining design rules how to work with oxide CMCs for engine parts
- Simulation of the parts behavior under engine loads
- Assessment of the lifetime and reliability of the material in operation to translate the specimen behavior onto the component level
- Optimizing the performance of the parts w.r.t. manufacturing parameters e.g. fiber orientation
- Characterizing the material properties needed for the design process on specimen level. This includes the material development for example to improve the matrix system for pre-preg technology

- Manufacturing of the demonstrator parts
- Develop a concept for defining qualification steps
- Develop a concept for non-destructive testing

For manufacturing oxide CMCs specimen and parts, the following manufacturing techniques are included in the project:

- Winding
- Pre-preg technology (as automated as possible)
- Braiding

This project answers the CfP in “Work Package 4 – Advanced Geared Engine Configuration (HPC-LPT)” of the Engine Integrated Technology Demonstrators in Clean Sky 2. It utilizes the low specific weight of oxide CMCs to save weight and its inherent oxidation and temperature resistant nature to save cooling air. It therefore, contributes to the key objectives of the work package: improvement of efficiencies and innovative lightweight and temperature resistant materials.

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