

Project Name: Reliability Assessment Methodology for Advanced Ceramic Matrix Composites (CMCs) (2020–2023)



Entrusted Parties: Tokyo University of Technology/ Japan Ultra-high Temperature Materials Research Center/ Japan Fine Ceramics Association

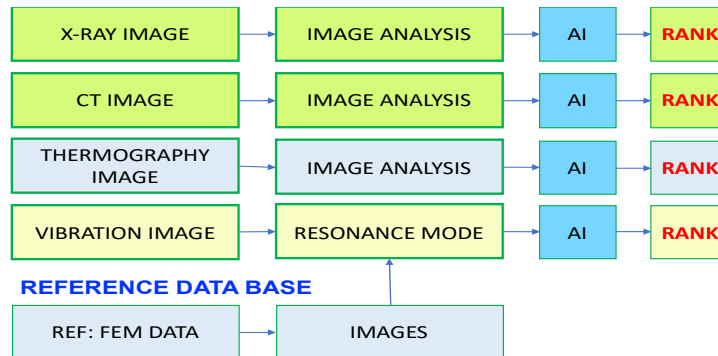
Outline of the project

CMC is lightweight and heat resistant, and its application to aircraft engines can reduce CO₂ emissions from aircraft.

In recent years, the practical application of CMC has started. However, the damage tolerance, which is the most important feature of CMC, obtained by the heterogeneity of the composite structure and the diversity of the fracture process, makes it difficult to guarantee the reliability of CMC components and prevents the expansion of practical CMC use, because all the individual components are different.

Therefore, in order to promote the expansion of CMC practical use, this project will develop a new method (as show in the figure below) that evaluates multiple inspection items for each CMC component using multiple inspection techniques, ranks each evaluation result, and

comprehensively evaluates them to ensure the reliability of CMC components. At the same time, it aims to develop internationally recognized methods through international joint research and to standardize methodology and measuring equipment internationally.



Significance of international R&D

In order to apply CMC components to aircraft engines, it is essential to obtain international certification, including quality assurance technology through OEMs (GE, P&W, RR). By developing standardization in collaboration with major CMC R&D institutes in the U.S. and Europe, we will gain international recognition, which facilitates OEM sales. The University of Birmingham and UCLA are CMC R&D centers in Europe and the United States respectively and coordinate joint research in their respective regions.

Project scheme

NEDO

Funding

Tokyo University of Technology,
Japan Ultra-high Temperature Materials Research Center,
Japan Fine Ceramics Association

Joint R&D contract

The University of Birmingham (UK)
The University of California, Los Angeles (US)

Expected outcomes

Implementation of CMCs for jet engines could cut CO₂ emissions by 6.5%/year resulting in 1x10⁸ tons in 10 years as CMC implementation rates for jet engines become 100%.

In addition to the development of CMC components, the creation of new industrial fields such as inspection equipment and software to ensure reliability is expected.

