

Microtextured Surfaces for Turbine Blade Impingement Cooling

Provides more effective internal impingement cooling

Gas turbine engine technology is constantly challenged to operate at higher combustor outlet temperatures. In a modern gas turbine engine, these temperatures can exceed the blade and disk material limits by 600 °F or more, necessitating both internal and film cooling schemes in addition to the use of thermal barrier coatings. Internal convective cooling is inadequate in many blade locations, and both internal and film cooling approaches can lead to significant performance penalties in the engine.

Micro Cooling Concepts, Inc., has developed a turbine blade cooling concept that provides enhanced internal impingement cooling effectiveness via the use of microstructured impingement surfaces. These surfaces significantly increase the cooling capability of the impinging flow, as compared to a conventional untextured surface. This approach can be combined with microchannel cooling and external film cooling to tailor the cooling capability per the external heating profile. The cooling system then can be optimized to minimize impact on engine performance.

Applications

NASA

- ▶ Turbine engine development
- ▶ Versatile Affordable Advanced Turbine Engine (VAATE) initiative
- ▶ Two-stage-to-orbit designs

Commercial

- ▶ Military and commercial aircraft:
 - Enables higher combustion temperatures with lower engine penalties
- ▶ Power generation plants:
 - Enables operation at higher temperatures and efficiencies
- ▶ Electronics
- ▶ Industrial processes
- ▶ Automotive
- ▶ Lasers



Phase II Objective

- ▶ Evaluate the suitability of high-temperature materials (e.g., from the Inconel® or HAYNES® series) in this application.

Benefits

- ▶ Increases cooling capability of the impinging flow
- ▶ Enables tailored cooling capability

Firm Contact

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Proposal Number: 10-2: A2.10-8672