



Keynote Speaker, Edward Gildersleeve, GE Aerospace Research

Thermally Sprayed Environmental Barrier Coatings in Industry and Academia: The Barriers to Industrialization and Bridging the Gap Between Innovative Research and Full-Scale Production

Abstract:

In the spirit of performance improvements, efficiency gains, and enhanced operational capacity, turbine manufacturers have sought after ever-increasing firing temperatures and lighter components. The introduction of the Leading Edge Aviation Propulsion (LEAP) Engine by CFM International in August 2016 saw the first commercial application of lightweight Ceramic Matrix Composite (CMC) components as direct replacements to their previous-gen superalloy counterparts. Being comprised of SiC, these CMCs required robust, durable, and reproducible Environmental Barrier Coatings (EBCs) that protected the components and enabled LEAP's success. Since 2016, over 225,000 shrouds have been manufactured, coated, and installed in engines, and LEAP has accumulated over 74 million flight hours.

The long-term success and reliability of these components is preceded by over four decades of intense internal and public research and development on EBCs as a materials system and a manufacturing technology. From the early 1980s with Solar Turbines and Oak Ridge National Lab coating SiC reactor rods, through the 1990s and early 2000s with the joint research of General Electric, Pratt and Whitney, and NASA in the High Speed Civil Transport (HCST) program – and beyond these programs when further development was internalized, EBCs have gone through at least two notional generations of design and implementation. This talk will strive to thread examples in the literature of the progression of thermally sprayed EBCs, whilst looking at the present status of public research, and the future, with a focus on industrialization and large-scale production and some of the general challenges met with endeavoring to introduce these otherwise-completely new coating systems into the fleet of modern commercial aircraft.

Biography:

Dr. Edward Gildersleeve received his Ph.D. from Stony Brook University under the advisement of Prof. Sanjay Sampath at the Center for Thermal Spray Research in 2022. He has been working in the field of thermal spray for the last ten years. Since beginning at Stony Brook as an undergraduate research aide, Dr. Gildersleeve has developed a skillset in almost all permutations of thermal spray processes such as Plasma Spraying and HVOF. He has mentored many students over the course of his career, a handful of which have chosen to continue and contribute to the field of thermal spray technology. Dr. Gildersleeve's Ph.D. research was centered around systematically investigating the failure of plasma-sprayed Thermal Barrier Coatings (TBCs). For instance, the effect of bond coat processing route on TBC durability, the effect of substrate geometry (conventional flat disk vs. curved surfaces), and attack by molten ingested debris (CMAS) have all been investigated during his Ph.D. work. In 2022, Dr. Gildersleeve did a two year

residence in Germany after being selected to receive an Alexander von Humboldt Postdoctoral Research Fellowship. He worked at the Forschungszentrum Jülich under Prof. Dr. Robert Vaßen in the Institute for Energy and Climate Research (IEK-1, now IMD-2). There, Dr. Gildersleeve studied high-temperature materials in Prof. Vaßen's group – specifically thermoelectric titanium oxide coatings and MultiLayered Thermal-Environmental Barrier Coatings (T-EBCs). Dr. Gildersleeve has contributed thirty papers to the field of thermal spray in his ten-year career – among which include a Journal of Thermal Spray Technology Best Paper Award in 2024. He has delivered even more oral presentations at various international conferences throughout the years, along with winning the International Thermal Spray Conference's Young Professional Speaking competition in 2018. In March of 2024, Dr. Gildersleeve joined the General Electric Global Research Center (now GE Aerospace Research) in Niskayuna New York as a Research Scientist. His research now focuses on using his ten-year knowledge to help advance the future of flight in aerospace with new, sophisticated coating technologies.

