A Novel Approach to Electric Aircraft Engines Using Thorium Dioxide Coated Tungsten Carbide Fins for Thrust Generation

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Currently, long-distance jet engines emit large amounts of carbon dioxide, harming the environment and fueling the effects of climate change. Last year, we proposed an electric design for a commercial jet engine that retrofitted a current engine with heated tungsten intake and compression fan blades to generate thrust. Although we demonstrated the feasibility of that design, we found the tungsten blades oxidized and deteriorated rapidly. This year, we redesigned those blades to be more resilient and effective in the high-stress environment of jet engines, including the ability to withstand oxidation and high temperatures. Our proposed fan blade is geometrically identical to those currently used in jet engines and made of tungsten carbide with a grain size in the submicron range. A one-molecule thick layer of thorium dioxide is deposited onto the surface of the blade using atomic layer deposition to prevent oxidation. Electricity passes through the tungsten carbide, causing it to reach engine operating temperatures, transfer heat to ingested air, and generate thrust. To determine the blade’s theoretical feasibility, we simulated its oxidation and thermal properties and recalculated how much thrust our design could generate in an engine. We found that the fan blade exhibited negligible oxidation and could transfer heat to air uniformly and efficiently. Overall, we illustrated that it is possible to create long-distance, commercially viable electric jet engines using our design, thereby mitigating the aviation sector’s environmental impacts by replacing jet fuels. In the future, we would like to explore other heating applications for our design.

Awards Won:

Third Award of $1,000