COMBUSTION CHAMBER DESIGN FOR LEAN-PREMIXED BIOFUEL OPERATION IN SMALL-SCALE AVIATION ENGINE

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The aviation industry's pursuit of a reduced carbon footprint and fulfilment of sustainability goals has driven the industry to consider Sustainable Aviation Fuels (SAFs) as a potential outcome. While SAF adoption presents new material challenges, the main hurdle to SAF use is dealing with the unique physical and chemical properties of SAFs versus conventional jet fuels. As we discussed, the important step is to realize advanced combustion strategies for SAFs. Micro gas turbines (mGTs) represent an ideal research platform for SAFs, as they possess the modular, flexible, and efficient characteristics needed to explore SAF combustion. A key strategy when operating a system with the goal of improved combustion efficiencies or minimum emissions of harmful combustion species (NO_x for example) is to operate in a lean-premixed process. In lean-premixed operation, a lower mass of fuel is needed, but more importantly allow a mechanism for an emission of NO_x reduction. This is particularly relevant when burning low-quality biofuels, which may have reduced energy density and less predictable combustion characteristics than conventional jet fuels. This report will focus on the design and optimization of a mGT combustion chamber suited to lean-premixed operation with biofuels to improve the efficacy of the propulsion system while improving the sustainability performance of the evolving aviation technology.

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