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Electric Field Flame Stabilization and Heat-Release Modulation

Low-power electric fields stabilize flames, cut NOx, and suppress thermoacoustic instabilities without moving parts.

Researchers at Purdue University have developed a cost-effective method for manipulating flames with electric fields. The electric field method can create flame stabilization points, modulate the total heat-release, or actively suppress thermoacoustic instabilities. The researchers used the method to stabilize a premixed methane-air flame so the flame could be operated leaner to reduce NOx. Unlike prior methods to control flames, Purdue's method uses no consumables or moving parts, has no electrodes in the flame, uses very little electrical power (40 mW to control a 11,000 BTU/h flame), and is significantly lower cost than alternatives. Applications of this technology include all industries that use continuous combustion processes. Examples include gas turbine engines for electricity generation and propulsion, residential devices (cooking, heating), industrial processes (burners, furnaces, boilers).

Publications: This work was presented at the AIAA SCITECH 2023 Forum (https://doi.org/10.2514/6.2023-0556)

Advantages

- Low cost

- Energy efficient

- Emission reductions

Applications

- Power generation

- Residential heating and cooking

- Industrial processes

Technology ID
2023-KING-70043

Category
Aerospace & Defense/Hypersonics & Propulsion Systems
Aerospace & Defense/Thermal Management & Combustion Optimization
Energy & Power Systems/Power Generation

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- Jet engines

Technology Validation:

This technology has been validated through the analysis and testing of proof of concept systems. Results showed success at suppressing thermoacoustic instabilities and control over heat output.

TRL: 4

Intellectual Property:

Provisional-Patent, 2022-11-30, United States

Utility Patent, 2023-11-28, United States

Keywords: Combustion, combustion controls, combustion equipment, Electric Fields, Emissions, Green Technology