Premixed, High-Pressure, Multi-Fuel Burner

Operates on a variety of gaseous fuels and oxidizers

NASA’s Glenn Research Center has developed a novel design for a fully premixed high-pressure burner capable of operating on a variety of gaseous fuels and oxidizers, including hydrogen-air mixtures, with a low pressure drop. The burner provides a rapidly and uniformly mixed fuel-oxidizer mixture that is suitable for use in a fully-premixed combustion regime that has the benefit of low pollutant emissions. Further, it is free from harmful flashback effects, combustion instabilities, and thermal meltdown problems that are normally associated with premixed combustion systems operating at high pressures. This burner can be easily scaled for use in practical low-emissions combustion systems such as stationary power plants or hydrogen-air combustion for vehicles. This technology is also applicable to process gas heaters, chemical processing, process gas afterburners, kiln or furnace burners, utility boiler burners, gas reforming burners, and fuel cell processing burners.

**BENEFITS**

- Robust: Operates on a variety of gaseous fuels and oxidizers
- Efficient: Provides a uniform zone of combustion products and temperatures and achieves complete and rapid mixing
- Stable: Expansion ratio helps to stabilize flame and provide more uniform flame zone
- Longer life: Self-cooled design
- Scalable: Offers a modular design that lends itself to scalability for larger power output applications
- Easy to manufacture: Features a design that is straightforward to manufacture with conventional techniques or with advanced methods
- Environmentally friendly: Lower fuel consumption and reduced emissions
- Safer: Operates at high pressures without harmful flashback effects, combustion instabilities, or thermal meltdown problems
THE TECHNOLOGY

NASA Glenn’s fully premixed burner design accomplishes the rapid mixing of the fuel and air flows while simultaneously providing backside impingement cooling to the burner face. This novel burner technology has been demonstrated to operate on hydrogen-air mixtures at pressures up to 30 bar, and at equivalence ratios (Phi) ranging from 0.15 to 5.0, but typically at equivalence ratios below 0.6 or above 2.0 for extended periods of time. It has also been demonstrated to work well with hydrogen-carbon monoxide fuel mixtures in a 1:1 mixture (by volume). The design provides a uniform zone of combustion products and temperatures, and is able to achieve complete and rapid mixing of the reactant gases over a distance as short as 5 mm, with the combustion products attaining a fully-reacted state within about 10 mm downstream of the burner face. Effectiveness of the mixing is not dependent on the use of hydrogen gas, therefore the system works well for other gaseous fuels such as methane, propane, or natural gas, in a fully premixed mode.

The design of the Glenn’s burner is simple and straightforward to manufacture using conventional techniques. The modular design of the burner lends itself to scalability for larger power output applications. This burner is simple to operate and is robust for use in an industrial setting such as low-emissions stationary gas turbine engine, or for aircraft gas turbine engines.

APPLICATIONS

The technology has several potential applications:

- Aircraft engines
- Furnaces (i.e., gas heaters, kiln or furnace burners, utility boiler burners, gas reforming burners, fuel cell processing burners)
- Power (i.e., stationary power plants; hydrogen-air combustion for vehicles)

PUBLICATIONS

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More Information

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