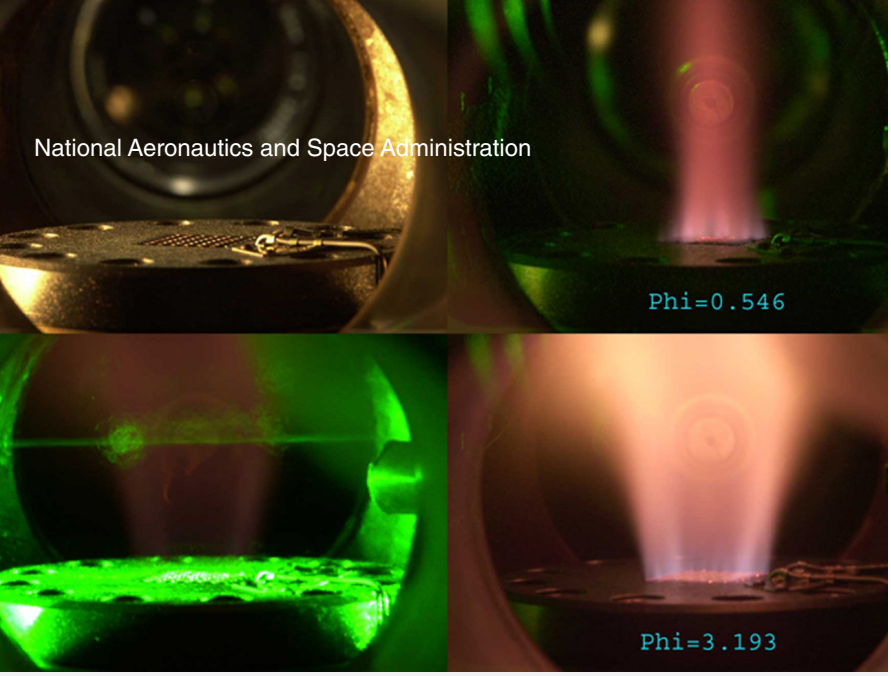


Propulsion

Fully Premixed, Low Emission, High Pressure, Multi-fuel Burner

A fully premixed high-pressure burner

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 (dP/P < 7%). 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 benefits of low pollutant emissions (when operated at fuel lean conditions) and freedom from harmful flashback effects, combustion instabilities, and thermal meltdown problems that are normally associated with premixed combustion systems operating at high pressures.

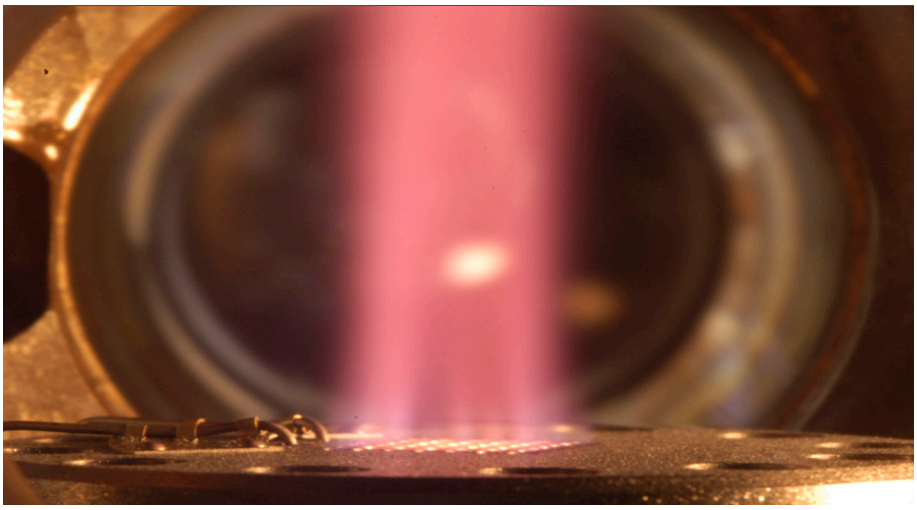
BENEFITS

- Flame control—design utilizes high speed jets to prevent flashback
- Flame stability—expansion ratio helps to stabilize flame and provide more uniform flame zone
- Enhanced safety
- Long life
- Robust
- Scalable
- Easy to manufacture
- Simple to operate

technology solution

THE TECHNOLOGY

The novel burner technology has been demonstrated to operate on hydrogen-air mixures 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 monixide 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 reaching a fully-reacted state within about 10 mm downstream of the burner face. Furthermore, the design of the 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. Finally, the 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.



Photograph of the technology operating at 10 atm inside an optically-accessible high pressure burner facility with premixed stoichiometric hydrogen-air reactants

APPLICATIONS

The technology has several potential applications:

- Aircraft
- Spacecraft
- Commercial/residential
- Heating and boilers

PUBLICATIONS

U.S. Patent 8,197,249

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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