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Data article

Experimental data regarding the characterization of the flame behavior near lean blowout in a non-premixed liquid fuel burner



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ABSTRACT

The article presents the data related to the flame acquisitions in a liquid-fuel gas turbine derived burner operating in non-premixed mode under three different equivalence fuel/air ratio, which corresponds to a richer, an intermediate, and an ultra-lean condition, near lean blowout (LBO).

The data were collected with two high speed visualization systems which acquired in the visible (VIS) and in the infrared (NIR) spectral region. Furthermore chemiluminescence measurements, which have been performed with a photomultiplier (PMT), equipped with an OH* filter, and gas exhaust measurements were also given. For each acquisition the data were related to operating parameters as pressure, temperature and equivalent fuel/air ratio.

The data are related to the research article “Image processing for the characterization of flame stability in a non-premixed liquid fuel burner near lean blowout” in *Aerospace Science and Technology* [1].

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Specifications Table

Subject area	Engineering
More specific subject area	Combustion, gas turbine

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Type of data	Table, image, figure
How data was acquired	VIS High rate CCD: MEMRECAM GX-3 [®] of NAC Image Technology NIR High rate CCD: FLIR A2600sc NIR camera Photomultiplier with OH* filter and data acquisition system: PMTSS of Thorlabs [®] , filter at (306.4 ± 5) nm, DAQ device of National Instruments [®] NI-USB 2008 Pollutant emissions analyzer: PG-350E Horiba Fuel mass flow meter: VSE 0.02 flow meter Air mass flow calculated by the Labview [®] control platform using the data measured by the pressure sensor Nuova Fima ST18 and by a t T-type thermocouple.
Data format	Raw data of the pixel intensity matrix of the flame images, of photomultiplier acquisition, of pollutant emissions and control platform
Experimental factors	Controlled temperature, pressure and fuel/air ratio
Experimental features	Experiments were realized at atmospheric pressure and preheating the air up to 500 K. Fuel/air ratio was fixed at different values and stabilized for 10 min before acquiring all the signals simultaneously.
Data source location	Green Engine Laboratory, Department of Engineering for Innovation, University of Salento-Lecce (Italy).
Data accessibility	The data are provided in supplementary files directly with this article.

Value of the data

- In the literature few experimental data are available for liquid-fuel gas turbine derived burner.
- Investigation of flame behavior near lean blowout is essential for the development of novel environmental friendly combustors. The identification of blowout precursor to be used for the development of a real time control system is essential to avoid the damage due to LBO.
- The provided data are suitable for comparing the burner with others characterized by different geometry and/or operative conditions.
- These experimental data permit to calibrate/validate numerical CFD modeling approaches for combustion and instabilities fields.

1. Data

Data in this paper are presented for three values of fuel/air ratios: a richer ($\Phi=0.333$), an intermediate ($\Phi=0.212$), and an ultra-lean condition ($\Phi=0.144$), in Supplementary files in the following series:

- Photomultiplier signals, which were acquired at 5 kHz for an acquisition time of 1 s. The table of 5000 values for three Φ are reported in the file “CONTROL_PMT_EMISSIONS”, sheet “PMT” in the [Supplementary material](#).
- Pollutant emissions data: NO_x, CO₂, CO, O₂, SO₂. They are recorded with a frequency of 1 Hz for 1 s of acquisition time. The single value of each species for the three values of fuel/air ratio are reported in the file “CONTROL_PMT_EMISSIONS”, sheet “POLLUTANTS” in the [Supplementary material](#).
- Control platform data: air mass flow, fuel mass flow, air inlet temperature, fuel inlet temperature, 3 values of temperature in the combustion chamber, combustion chamber pressure. The platform acquires at 4 Hz and the data acquired in 1 s are reported. They are reported in the file “CONTROL_PMT_EMISSIONS”, sheet “CONTROL PLATFORM” in the [Supplementary material](#).
- Luminosity matrix of the VIS images. The images were taken at 10 kHz for 1 s of acquisition time. The resolution is 288 × 384 (0.31 mm/pixel). Here only 1000 images are reported. Two 3D matrix of

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