Overview

The advantages that have in the past made acetone concentration imaging attractive have recently been exploited for temperature imaging, using acetone PLIF with single- or dual-wavelength excitation. Taking advantage of experimental data mapping out the excitation-wavelength-dependent variation of acetone fluorescence with temperature, thermometry has been performed on a variety of flows.

Below, a steady flow of acetone-seeded air over a 3 mm diameter heated cylinder is visualized. Using a single-wavelength PLIF technique with a 248 nm excimer laser, the temperature in the flow is measured and is shown using a repeated color table. From this image it is inferred that precision of 1 K is quite reasonable.

![Figure 1: Steady flow of acetone-seeded air over a 3 mm diameter cylinder](image)

The ability of acetone PLIF thermometry to resolve instantaneous flow structure is shown below. Using a frequency-quadrupled Nd:YAG laser at 266 nm, the Kelvin-Helmholtz type instabilities of a heated jet in cold crossflow (jet Reynolds number= 100) are visualized.

![Figure 2: Instantaneous flow field structure](image)
Below, a dual-wavelength excitation technique has been used to measure temperature and mixture fraction nearly simultaneously in a turbulent heated jet. 65 mJ laser pulses at 248 and 308 nm are separated by 800 nsec and collected separately by a fast frame-transfer camera. Temperature resolution is about 7 K while mixture fraction can be resolved to 2%.

![Image of dual-wavelength excitation technique](image)

**Figure 3: Dual-wavelength excitation technique**

**References**

