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## Combustion of a single aluminum droplet burning in O<sub>2</sub>/CO<sub>2</sub>/N<sub>2</sub> mixtures

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Relying on many experiments, many authors proposed to consider the effect of oxidizer efficiency, ambient pressure and ambient temperature on aluminum particle burning time. Efforts to describe aluminum combustion process and combustion time assessments must be extended to elaborate more accurate correlations.

This experimental study aims at analyzing the autonomous combustion of 30-150 μm Al particles using electrostatic levitation to isolate a single particle in different ambient conditions in terms of pressure (1-50 bars) and composition (Air, O<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub> and mixtures). Combustion is initiated by a CO<sub>2</sub> laser beam and optical emission of burning Al particle is recorded using filtered photomultipliers and a high-speed camera. Exploitation of digital sequences using numerical image processing permits the temporal determination of combustion parameters (droplet diameter, flame diameter, displacements speed and emission intensity) and thus make it possible to quantify the impact of influential factors.

Experiments in air with varying pressure highlight the effect of this parameter both on combustion time and phenomenology. For low pressures (< 5 bar), different stages are distinctly discerned. Otherwise, increasing pressures modifies the combustion sequence. Observations in CO<sub>2</sub> show a combustion history similar to that in air however slower and less disturbed. In comparison with air, the oxide lobe has a different wetting angle and is more spread on droplet surface and the flame diameter is also reduced. The combustion process observed in CO<sub>2</sub> remains similar even for increased pressures. Only O<sub>2</sub>/CO<sub>2</sub>/N<sub>2</sub> mixtures are presented here but future works will also address CO or H<sub>2</sub>O atmospheres.