



## **Atomization of emulsified alternative fuel assisted by water drops sudden vaporization (micro-explosion)**

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Combustion of alternative fuels (such as vegetable oil, animal fat, ...) remains a challenge if we want to achieve a “clean combustion” avoiding not only low CO<sub>2</sub> but also low NO<sub>x</sub>, CO, Unburned and Soot emissions. These alternative fuels present indeed high viscosity and low volatility leading to a poor atomization and high pollutant emissions. Water-in-Oil emulsification can reduce this pollution very significantly. The difference in boiling temperature between the continuous and the dispersed phase can generate indeed a phenomenon named “Micro-Explosion” leading to a “second atomization”. This second atomization ends up in a cloud of numerous small oil child droplets, allowing an efficient vaporisation of the oil, a good air-fuel mixing and a low flame temperature. However, the “Micro-Explosion” itself is very complex with coupled phenomena regarding the dispersed phase inside the emulsified oil drops (sedimentation, convection, coalescence ...). It needs to be studied in deep.

This Keynote will focus mainly on experimental studies on Water-in-Oil (W/O) droplets atomization. These studies started more than 10 years ago in the context of a strong collaboration between CNR (IM and now STEMS) and LTeN at Polytech Nantes. Deep investigations of the water droplets inside the emulsion drop where performed using ad hoc optical diagnostics. Sizes, positions, velocities and temperatures of dispersed phase droplets have been measured and the conditions leading to an optimal Micro-Explosion are now rather well known. This lecture will also present a new device that generates emulsified fuels at high flow rate in a continuous way. This new device is based on micro-channels. It has been deeply investigated thanks to optical diagnostics again. Some experiments using this device in order to feed an optical CI Engine will also be shown during the Keynote..

**Keywords:** Please include 3 to 4 Keywords.

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