



ISTITUTO MOTORI

Consiglio Nazionale delle Ricerche

AVVISO DI SEMINARIO

Lunedì 21 luglio 2014, ore 11:00
Istituto Motori - CNR, Aula Ferretti

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Atomization of Water in Oil Emulsions: Una Storia

Burning emulsified fuels with water is considered as a quite promising clean solution to bring out different fuels as inferior quality oils. The advantage of using the water in oil (W/O) emulsions is a remarkable simultaneous reduction of nitric oxide and particulate emissions after combustion. This interesting property is connected to the presence of water by a phenomenon known as micro-explosion, leading to the second-atomization effect.

Atomization of emulsified fuel droplets has been intensively studied since 2008 in Nantes Thermocinétique Lab (LTN). This study follows engine tests regarding combustion of waste animal fat that were previously performed at Ecole des Mines in Nantes [1, 2]. The present seminar will firstly sum up the main results of these engine tests.

The second point in the seminar will focus on one particular result: the effect of water drop size on the atomization quality [3]. Figure 1 shows two different micro-explosions due to the vaporization of water drops with different initial diameters. Collaboration with CNR-IM in Naples started in 2011. Thermal analysis of micro-explosions was then performed both in Nantes [4] and Naples [5] showing again an important effect of the water drop size.

Energy analysis of micro-explosions is now investigated both thermally [6] and mechanically speaking [7]. Methodology and main results will be given in the third and last point of the seminar. Some perspectives regarding emulsion preparation will also be given at the end.





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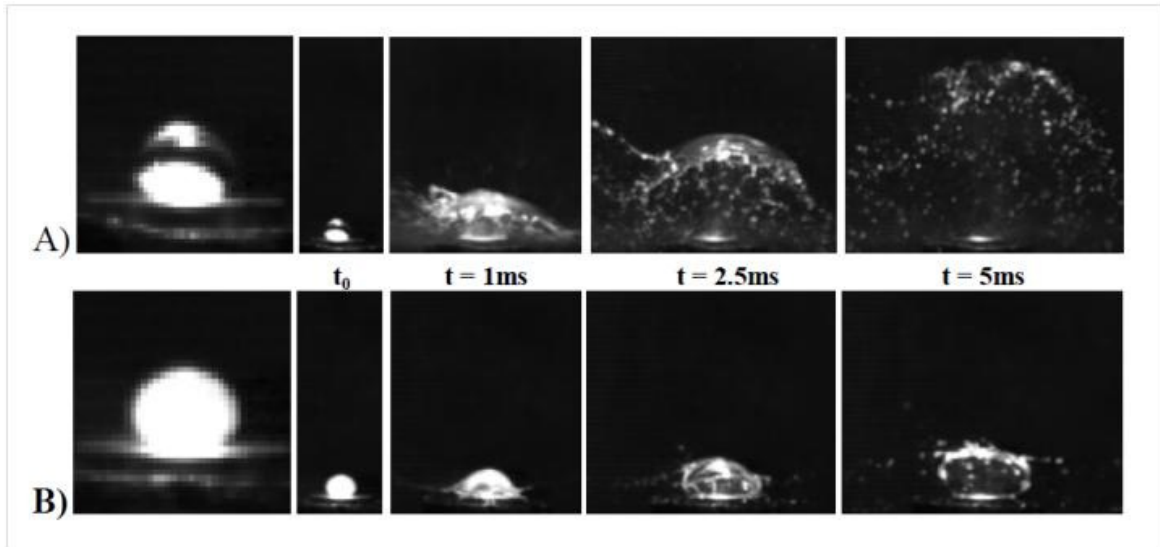


Figure 1. Video frames of two different micro-explosions (A) optimal water drop size and (B) non-optimal

References

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- [2] Senthil Kumar M., Bellettre J. and Tazerout M., Use of bio-fuel emulsions in diesel engines – A review. *IMEchE Journal of Power and Energy*, 2009, Vol. 223, N°7, p. 729-744.
- [3] Mura E., Josset C., Loubar K., Huchet G. and Bellettre J. Effects of dispersed water droplets size in Micro-explosion phenomenon for water in oil emulsions. *Atomization and Sprays*, 2010, N°9, p.791-799.
- [4] Mura E., Massoli P., Josset C., Loubar K. and Bellettre J. Study of the micro-explosion temperature of water in oil emulsion droplets during the Leidenfrost effect. *Experimental Thermal and Fluid Science*, 2012, Vol. 43, p. 63-70.
- [5] Mura E., Calabria R., Califano V., Massoli P. and Bellettre J. Emulsion droplet micro-explosion: Analysis of two experimental approaches. *Experimental Thermal and Fluid Science*, 2014, Vol. 56, p. 69-74.
- [6] Tarlet D., Mura E., Josset C., Bellettre J., Allouis C. and Massoli P. Distribution of thermal energy of child-droplets issued from an optimal micro-explosion. *Int. J. Heat Mass Transfer*, 2014, Vol. 77, p. 1043-1054.
- [7] Allouis C., Tarlet D and Bellettre J. Measurement of planar velocity of child-droplets issued from series of optimal micro-explosions. 26th Annual Conference on Liquid Atomization and Spray Systems, 8-10 September 2014, Bremen (Germany) (to appear).

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