Antibubbles, Liquid Onions, And Mayonnaise Droplets

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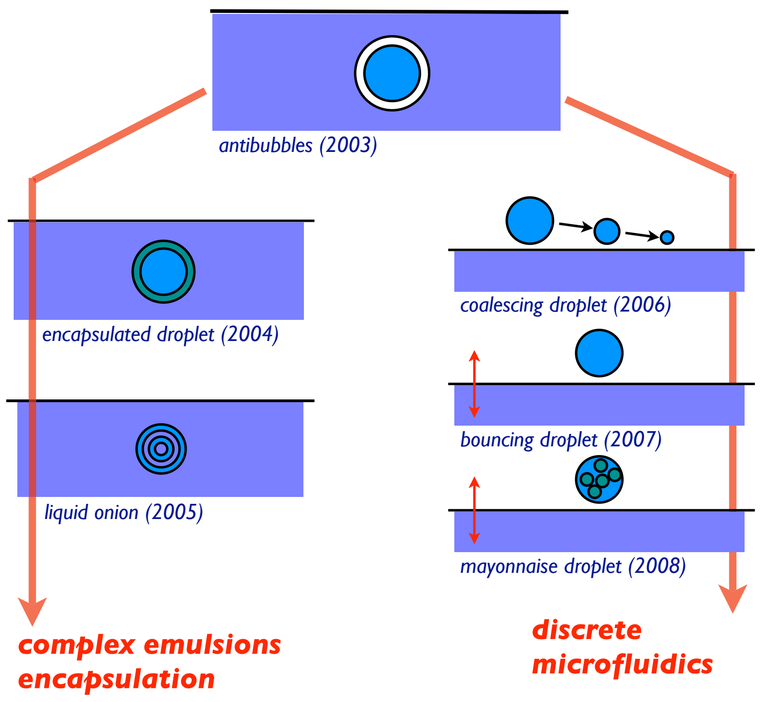
Scientific strategy

Since 2003, the GRASP at the University of Liège has developped a series of experimental methods for manipulating droplets along air/liquid interfaces. Originating from our work on antibubbles [1], two approaches have been pursued : (i) sinking the droplet below the interface and (ii) maintaining a non-coalescing droplet onto the interface.

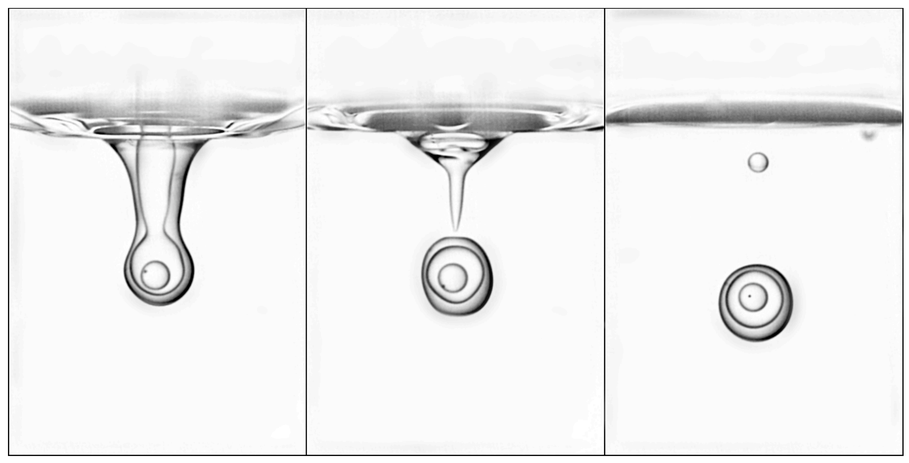


Antibubbles

Antibubbles are created when a soapy liquid jet is impacting a liquid bath of the same liquid. The liquid jet crosses through the interface and a thin air film is entrained below the interface. The cylindrical air film eventually decomposes into antibubbles [1].

Liquid onions

The encapsulation of the incoming droplet with a thin oil layer can be obtained. The diameter of the encapsulated droplet is roughly 1 millimeter. No surfactant molecule is requested to create such particular object! For high impact velocities and for particular sets of parameters, one observes eventually multi-layered droplets. Such a fluidic object is characterized by two spherical oil shells.



Mayonnaise droplets

A bouncing oil droplet [2,3] has initially a liquid core made of a water/surfactant mixture surrounded by oil. When the viscosity of the oil is low and when the acceleration of the liquid bath is high, the droplet is highly deformed at each cycle. Such deformations induce the introduction of tiny oil droplet into the water core of the bi-droplet. After a few cycles, the oil droplet contains a set of water microdroplets. A microemulsion is thus contained in the bouncing droplet.

References

[1] S.Dorbolo, H.Caps and N.Vandewalle, *New J. Phys.* 5, 161 (2003)
[2] T.Gilet, D.Terwagne, N.Vandewalle, S.Dorbolo,
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[3] D.Terwagne, T.Gilet, N.Vandewalle, S.Dorbolo, *Chaos* 18, 041104 (2008)