Comparison between Laser Induced Plasmas in gas and in liquid.

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In this work the main peculiarities of Laser Induced Plasma (LIP) in liquid have been investigated by comparing the evolution of the LIP in water and in air. To this end fast shadowgraphy and temporally resolved emission spectroscopy were used. The experimental results reveal a scenario where plasma under water remains in a high-density state, characterized by the condensation of electronic levels as a consequence of the confinement effect of the surrounding water. In this case the plasma emission spectrum consists of continuum radiation. In contrast, LIP in air expands, reaching an ideal plasma state in a few hundred nanoseconds. In this condition, excited electronic levels are enabled and the spectrum is characterized by discrete emission lines, according to Boltzmann statistics. Moreover, a brief description of the fate of the LIP material, after plasma extinction, in air and water is given. These differences allow LIP in liquid and gas to be used in a wide variety of applications, ranging from analytical chemistry to nanomaterial production.

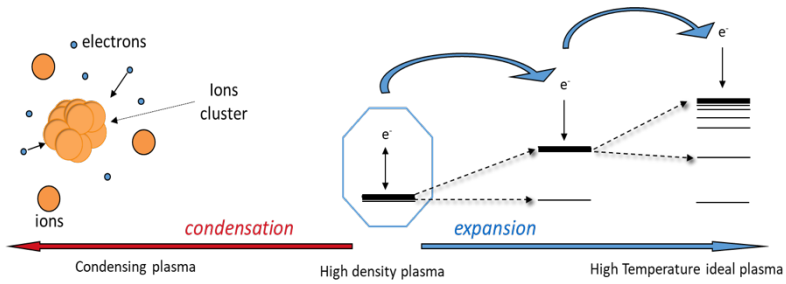

Fig.1 Sketch of different possible evolutions of a high density plasma.

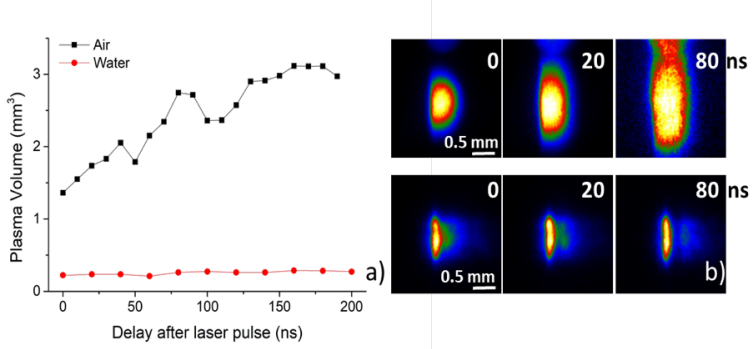

Fig.2 Temporal evolution of plasma volume in water and air.