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Microplasmas in liquids

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Plasma discharges from 1 ?m to 10 ?m in size can be generated in a variety of liquids by the use of nanosecond duration high voltage pulses of low energy. Through a variety of high temporal and spatial resolution diagnostic the plasma discharge formation, growth and properties are studied. Experiments reveal the plasma is confined inside of a small lower density region, or bubble, in the fluid. This bubble is generated commensurate with the plasma formation and the stability and rate of bubble growth is input energy and medium dependent. Emission spectroscopy indicates the microscale plasmas to be non-equilibrium but only when the lowest energy, and smallest, discharges are generated. The non-equilibrium and high surface to volume ratio of the microplasmas offers a unique set of liquid phase plasma chemistries. Various schema for generating both highly localized and volumetrically distributed non-equilibrium microplasmas in liquids are presented. When applied to the reforming of fuels and oils the advantages of the non-equilibrium discharge in liquid regime lead to more control over the product compositions.