AN INVESTIGATION OF HARMONICALLY DRIVEN FREE STANDING BUBBLES IN A WIRE-PLANE ELECTRODE GEOMETRY*

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In this paper we investigate the effects of a nonuniform electric field on free standing air bubbles in water. An air pump is used to launch bubbles into a water filled glass tube where they pass between electrodes arranged in a wire-plane geometry. An electric field is applied between the electrodes by a 20 kV AC power supply and the response of the bubble is captured using a high speed camera (10,000 fps).

Due to the large difference between the dielectric constants of water and air, the electric fields in the electrode gap will be refracted and focused to the region inside or near the bubble surface[1]. This concentrated field strength will tend to polarize the bubble surface and subject the bubble to a dielectrophoretic force[2,3], which may result in a deformation of the bubble's shape. If the electric field is further driven at the natural oscillation frequency of the bubble (0.1-1.0 kHz)[4], the dielectrophoretic force may severely modify both the gas dynamic and dielectric properties inside the bubble. The goal of this work is to investigate these physical processes for the case of a single bubble that is physically separated from all electrode surfaces. A better understanding of these effects could be used to facilitate the process of plasma breakdown in water.

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