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Droplet Impact on a High Frequency Vibrating Surface

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Abstract : Ultrasonic atomization is used to generate micron size aerosols. In this work, the aerosol formation by the atomization of a parent droplet dripping from a capillary needle onto the surface of a Teflon coated piezoelectric vibrating at 2.5 MHz is studied, and different steps of atomization are categorized. After the droplet impacts on the piezoelectric, surface acoustic streaming deforms the droplet into a fountain shape. This fountain soon collapses and forms a liquid layer. The breakup of the liquid layer results in the generation of both large (100 microns) and small drops (few microns). Next, the residual drops from the liquid layer start to be atomized to generate few micron size droplets. The high velocity and explosive aerosol formation in this step are better explained in terms of cavitation theory. However, the combination of both capillary waves and cavitation theory seem to be responsible for few-micron droplet generation. The current study focuses on both qualitative and quantitative aspects of fountain formation for both ethyl-alcohol and water. Even though the general steps of atomization are the same for both liquids, the quantitative results indicate that some noticeable differences lie between them.

Keywords : droplet breakup, ultrasonic atomization, acoustic streaming, droplet oscillation
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