26th ANNUAL MEETING OF THE FINE PARTICLE SOCIETY
August 22-25, 1995
Chicago, Illinois
ABSTRACT

The Dynamics of Non-Spherical Single 1 Drops and Bubbles and Applications to Material Characterization

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Single fluid particle levitation and manipulation methods have been used to characterize the dynamic response of non-spherical droplets and bubbles immersed in an outer fluid in order to investigate the effects ultrasonic and electric fields as well as of those of shape deformation. A novel approach combining the action of both ultrasonic radiation pressure and electric Coulomb force has allowed the controlled suspension of charged and uncharged droplets having diameter between 0.1 and 5 mm in gaseous and liquid hosts with a capability to continuously vary the shape of the particle. Detailed quantitative measurements of the resonant shape oscillations frequencies and of the decay-time constant can provide the means to measure and to monitor the bulk and surface properties of the small sample as a function of temperature, time, hydrostatic pressure, and composition of both the sample as well as host medium. The same approach also allows the experimental observation of a single or a small number of gas or vapor bubbles stably positioned in a host liquid, The linear and nonlinear dynamics of bubbles with diameter between 0.05 and 10 mm can be examined for extended periods of time in order to characterize their surface properties. Applications can be found in the areas dealing with the measurement of thermophysical bulk properties in metastable liquid states, the study of first order phase transitions, crystal growth from solution or melt, the determination and monitoring of surface properties of pure liquids and of surfactant solutions, the fission and coalescence mechanisms of drops and bubbles, and the heat and mass transfer processes in specific two-phase flows model systems.

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