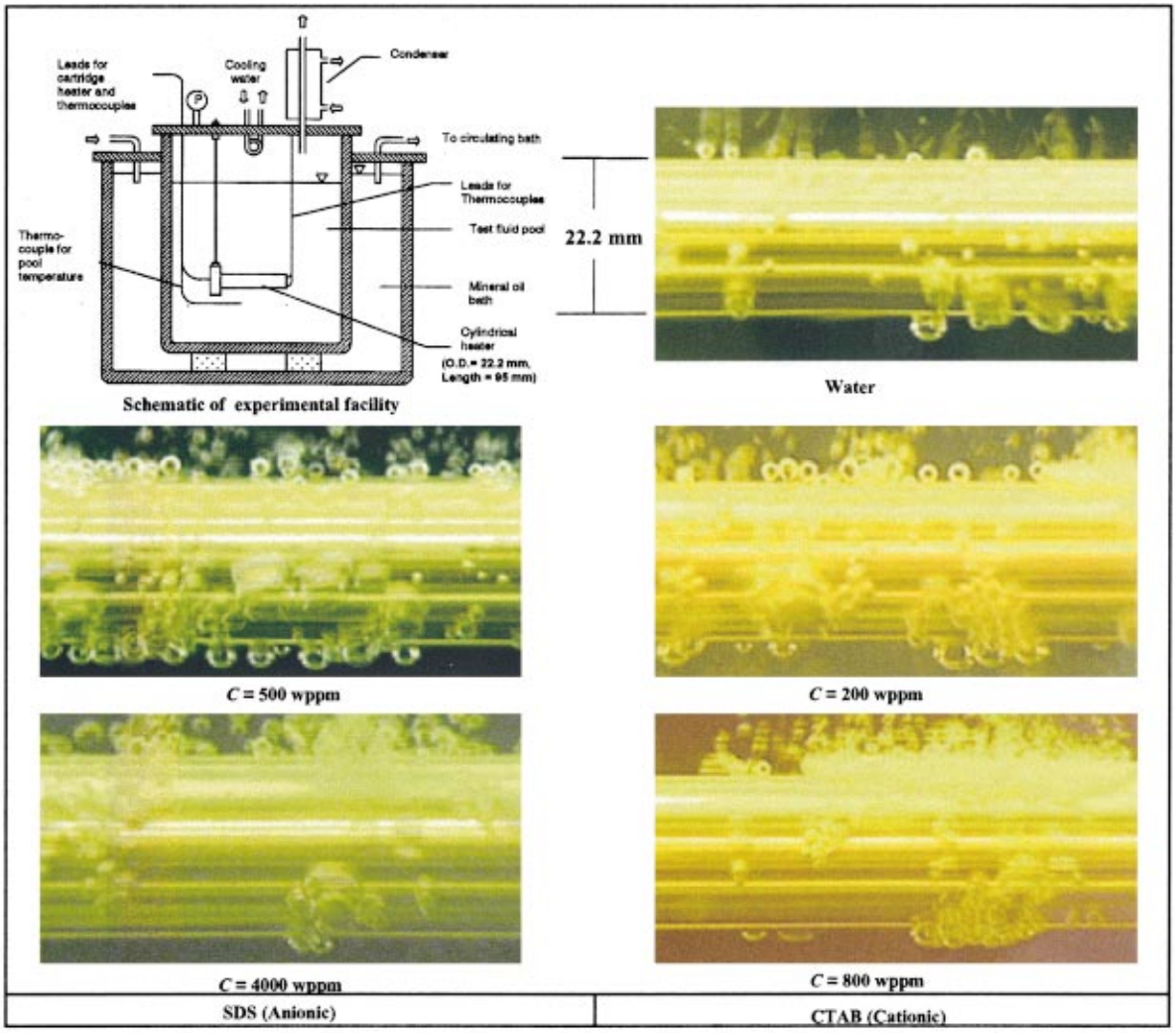

Fig. 1 Boiling behavior for distilled water, and aqueous SDS and CTAB Solutions at $q''_w = 20$ kW/m²

VISUALIZATION OF EBULLIENT DYNAMICS IN SURFACTANT SOLUTIONS

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Saturated, nucleate pool boiling behavior of aqueous surfactant solutions on a horizontal, cylindrical heater and the associated bubble dynamics has been experimentally observed. Two surfactants of different ionic nature, molecular weight, and critical micelle concentration, SDS (anionic, M = 288.3, c.m.c ≅ 2500 wppm) and CTAB (cationic, M = 365.4, c.m.c. ≅ 400 wppm) are employed, and the bubbling activity is recorded at different concentration levels. The growth of nucleating vapor bubbles and their motion near the cylindrical heater surface were recorded by a PULNiX TMC-7 high-speed color CCD camera with shutter speeds of up to 1/10,000 second. This is interfaced with a PC through a FLASHBUS MV pro image capture kit that has high-speed PCI-based bus mastering capabilities (up to 132 Mbytes/s). A FUJI 12.5 – 75 mm micro lens was used on the CCD camera to facilitate high quality close-up photography. The bubbling dynamics for SDS and CATB solutions of different concentrations and that of deionized distilled water are presented. Boiling in surfactant solutions is seen to be more vigorous in comparison to that in water, and is characterized by clusters of smaller-sized and more regularly shaped bubbles. With a significantly higher bubble departure frequency, there is virtually no coalescence of either the neighboring bubbles or sliding bubbles that come in contact with others around the heater's periphery when the surfactant concentration is smaller than c.m.c. However, in post-c.m.c. boiling, increased coalescence between vapor bubbles with considerable surface foaming is observed. Furthermore, the difference in bubble clusters and number of active nucleation sites in the ebullient behavior of SDS and CTAB, are reflective of their different ionic nature, molecular weight, and interfacial diffusion characteristics.