Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Small Scale Evaporation Kinetics of a Binary Fluid Mixture CARL BASDEO, DEZHUANG YE, DEVENDRA KALONIA, TAI-HSI FAN, University of Connecticut, MECHANICAL ENGINEERING TEAM, PHARMACEUTICAL SCIENCES COLLABORATION — Evaporation induces a concentrating effect in liquid mixtures. The transient process has significant influence on the dynamic behaviors of a complex fluid. To simultaneously investigate the fluid properties and small-scale evaporation kinetics during the transient process, the quartz crystal microbalance is applied to a binary mixture droplet of light alcohols including both a single volatile component (a fast evaporation followed by a slow evaporation) and a mixture of two volatile components with comparable evaporation rates. The density and viscosity stratification are evaluated by the shear wave, and the evaporation kinetics is measured by the resonant signature of the acoustic p-wave. The evaporation flux can be precisely determined by the resonant frequency spikes and the complex impedance. To predict the concentration field, the moving interface, and the precision evaporation kinetics of the mixture, a multiphase model is developed to interpret the complex impedance signals based on the underlying mass and momentum transport phenomena. The experimental method and theoretical model are developed for better characterizing and understanding of the drying process involving liquid mixtures of protein pharmaceuticals.

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Date submitted: 27 Nov 2012 Electronic form version 1.4