Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Assessing Quasi-Steady State in Evaporation of Sessile Drops by Diffusion Models[1] CAMERON MARTIN, HOA NGUYEN, PETER KELLY-ZION, CHRIS PURSELL, Trinity Univ — The vapor distributions surrounding sessile drops of methanol are modeled as the solutions of the steady-state and transient diffusion equations using Matlabs PDE Toolbox. The goal is to determine how quickly the transient diffusive transport reaches its quasi-steady state as the droplet geometry is varied between a Webers disc, a real droplet shape, and a spherical cap with matching thickness or contact angle. We assume that the only transport mechanism at work is diffusion. Quasi-steady state is defined using several metrics, such as differences between the transient and steady-state solutions, and change in the transient solution over time. Knowing the vapor distribution, the gradient is computed to evaluate the diffusive flux. The flux is integrated along the surface of a control volume surrounding the drop to obtain the net rate of diffusion out of the volume. Based on the differences between the transient and steady-state diffusive fluxes at the discrete points along the control-volume surface, the time to reach quasi-steady state evaporation is determined and is consistent with other proposed measurements. By varying the dimensions of the control volume, we can also assess what regimes have equivalent or different quasi-steady states for different droplet geometries.

[1]Petroleum Research Fund

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Date submitted: 27 Jul 2017 Electronic form version 1.4