

Theory of Thin-Film Evaporation

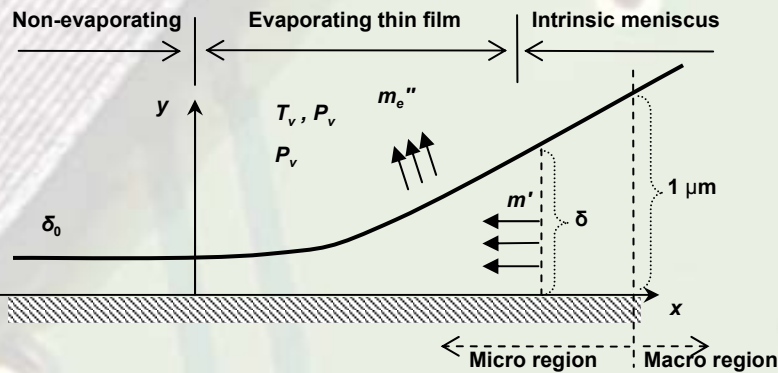
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OBJECTIVE

Develop a comprehensive understanding of the evaporation processes occurring at the thin liquid film near the contact line

APPROACH

Schematic diagram for an evaporating thin film



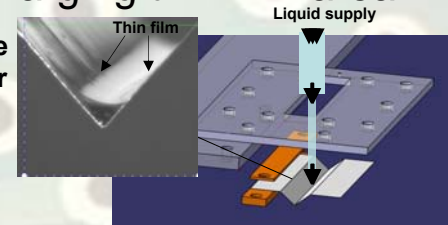
Fourth-order ODE for thin-film profile

$$\frac{d}{dx} \left\{ \left[\delta''' (1 + \delta'^2)^{-1.5} \sigma - 3\delta' \delta''^2 (1 + \delta'^2)^{-2.5} \sigma - \frac{3A}{\delta^4} \delta' \right] \frac{\delta^3}{3\nu} \right\} = -m_e''$$

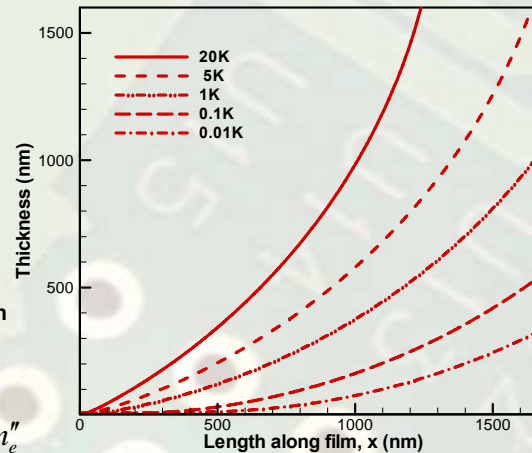
IMPACT

- Thin-film region associated with very high heat transfer rates
- Provide accurate calculation of meniscus evaporation which is critical for boiling and heat pipe design
- Provide guidelines for sustaining and enlarging thin-film area

V-groove setup for thin film study



Thin film profile under different wall superheat



SELECTED PUBLICATIONS

- H. Wang, S. V. Garimella and J. Y. Murthy, *Int J Heat Mass Transfer* (in press).
- H. Wang, J. Y. Murthy and S. V. Garimella, IMECE2006-13898, Chicago II., 2006.
- H. Wang, S. V. Garimella and J. Y. Murthy, IMECE2006-13899, Chicago II., 2006.