A Point Sink Superposition Method for Predicting Droplet Interaction Effects During Vapor-Diffusion-Driven Dropwise Condensation in Humid Air

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**Objective**

Develop a reduced-order analytical method to calculate the condensation rate of individual droplets within a group of droplets on a surface by resolving the vapor concentration field in the surrounding air.

**Approach**

- Develop a superposition method for the solution of the diffusion equation for a single droplet
- Calculate the condensation rate of multiple droplets with varying size and pitch by using numerical simulation
- Compare condensation rates of individual droplets obtained from the numerical simulations and from the model

**Results**

The condensation rate of the droplet within a system of multiple droplets can be obtained from:

$$\eta_i + \sum_{j=1, j \neq i}^{N} \eta_j \left( \frac{R_{cj}}{r_i - r_j} \right) = 1$$

where:  $$\eta = \frac{\dot{m}_{sys}}{\dot{m}_{iso}}$$

**Impact**

An accurate model for the time-evolution of dropwise condensation from humid air has can improve the design of industrial systems that involve condensation from humid air.

**Selected Publication**