Spatial distribution modeling of droplets during water dropwise condensation on textured surfaces
Solmaz Boroomandi Barati, Nicolas Pionnier, Jean-Charles Pinoli, Stéphane Valette, Yann Gavet

To cite this version:

HAL Id: hal-01498839
https://hal.archives-ouvertes.fr/hal-01498839
Submitted on 13 Apr 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
Spatial distribution modeling of droplets during water dropwise condensation on textured surfaces

S. Boroomandi Barati¹, N. Pionnier², J.-C. Pinoli³, S. Valette², Y. Gavet⁴

1. Univ Lyon, Ecole Nationale Supérieure des Mines de Saint-Etienne, LGF UMR CNRS 5307, SAINT-ETIENNE, France
2. Univ Lyon, Ecole Centrale de Lyon, LTDS UMR CNRS 5513, F-69134, LYON, France
3. Ecole Nationale Supérieure des Mines de Saint-Etienne, LGF UMR CNRS 5307, SAINT-ETIENNE, France

SIMULATION ALGORITHM

- 1500 initial random points with size of 1μm
- Droplets growth at each time step by diffusion and coalescence
  \[ r_{\text{new}} = [(r_{\text{old}})^2 + G]^{1/2}, \quad G = 4.15 \frac{K \Delta T}{H \rho} \]
- \( K = \) water thermal conductivity, \( H = \) heat of condensation and \( \rho = \) water density
- Nucleation of new bubbles in each step

RESULT

- Model validation using Ripley function (It basically evaluates the mean number of drops within a specific distance from each drop center)
- Good agreement between model and experimental results
- Deviation from Poisson process because of coalescence

Figure 1: Results of model and experiment for Droplets distribution on a flat surface.

Figure 2: Ripley function of results of model and experimental data.

PERSPECTIVE

- Investigation the effect of surface topography on droplets nucleation
- Size and shape analysis
- Other point process: Hard core process