

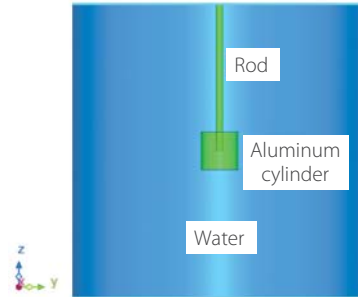
Boiling Simulation

Comparison of film boiling simulation and experiment

Analysis Objectives

Boiling involves huge heat transfer due to latent heat. It is vital for numerical simulation for temperature prediction. In this case study, numerically simulated boiling behavior was compared with experiment. In the experiment, a heated aluminum rod descended into water and instantly water vapor surrounded the rod: this is so called "film boiling". In simulation, the initial temperature of rod fixed in water is high. Lee model was adopted in this simulation.

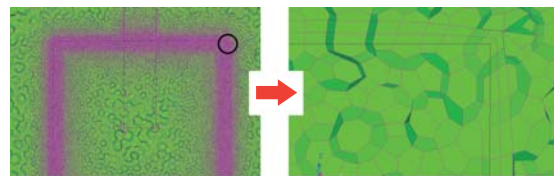
Analysis details and mesh around aluminum cylinder



Initial temperature of aluminum:
540°C

Initial water temperature:
100°C (tiny temperature raise will inset of boiling)

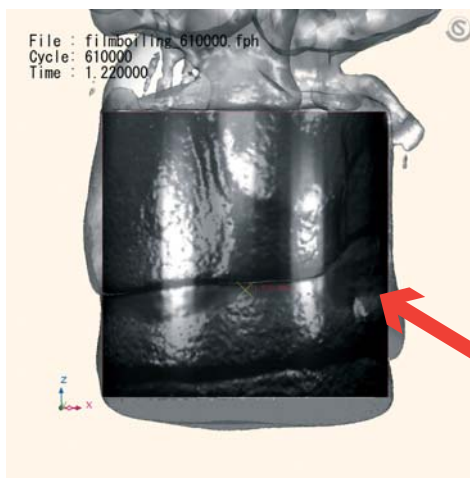
Time:
2 μ s



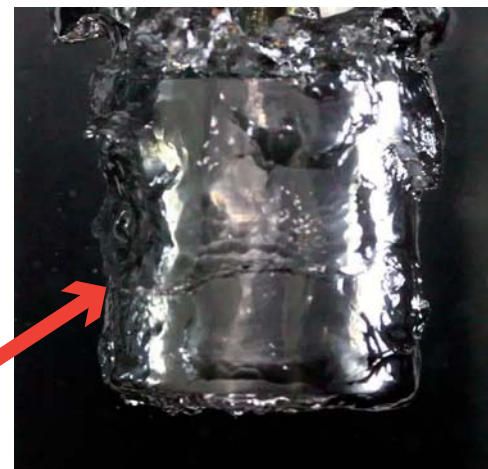
Number of elements:
1.4M

Boundary layer:
2 layers (1mm)

Analysis result, gas-liquid interface shape



Wavy
behavior



Picture provided by Dr. Kaoru Toyoda,
Maizuru National College of Technology

In the experiment, the rod dropped into water but in simulation the rod stayed in water from initial time. To adjust this difference, we compared simulation and experiment at the same temperature of 530 °C in the same point of the rod.

Notes

- FIRM (Fine Interface Reconstruction Method) feature, a highly accurate VOF method, was used in this film boiling simulation.
- The simulated film boiling behavior was qualitatively close to actual experiment, although coarsely generated mesh elements of 1mm prism layer size were used.