Supporting Information

Nanostructured Copper Interfaces for Enhanced Boiling

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Calculation of Heat Flux and Wall Superheat

The data from the pool boiling experiments were categorized to obtain two main parameters; the heat flux (q") and the wall superheat (T_W - T_{sat}). The heat flux dissipated through evaporation/boiling under steady state conditions was obtained as follows:

$$q'' = K_{cu}\left[\left(T_{TC3} - T_{TC2}\right) + \left(T_{TC2} - T_{TC1}\right)\right] \Big/ 2t_{hole} \qquad (1)$$

Here the terms T_{TC1}, T_{TC2} and T_{TC3} represent the temperature for the three K-type thermocouples (TC_1, TC_2 and TC_3) that were used to monitor the axial temperature distribution

in the copper heater. The separation between the sensors was ~10 mm (t_{hole}) and K_{cu} is the known thermal conductivity of Cu.

The wall temperature (T_w) and the liquid saturation temperature (T_{sat}) were expressed as follows:

$$T_W = T_{TC1} - q" t_{STC1} / K_{cu} \quad (2)$$

$$T_{sat} = (T_{TC4} + T_{TC5} + T_{TC6}) / 3 \quad (3)$$

where t_{STC1} was the distance between the TC_1 sensor and the solid surface (~0.5 mm). The terms T_{TC4}, T_{TC5} and T_{TC6} represent the temperature for the three thermocouples (TC_4, TC_5 and TC_6) that were used to monitor the water temperature in the test chamber. The wall superheat was then estimated using the relation:

$$T_W - T_{sat} = T_{TC1} - (T_{TC4} + T_{TC5} + T_{TC6}) / 3 - q" t_{STC1} / K_{cu} \quad (4)$$

Naturally occurring microscale cavities on Cu surface without nanorod deposition

In spite of mechanical polishing, the copper (Cu) substrates on which the Cu nanorod depositions were performed were not perfectly smooth and were populated with microscale surface features and cavities as indicated in the scanning electron microscopy image shown below. Without the stability provided by the nano-pores, these naturally occurring microscale cavities were unable to support stable bubble nucleation at low superheated temperatures (Fig. 2b in Manuscript). We expect this is because the micro surface defects are unable to effectively trap air to form gas-liquid interface and are readily flooded upon introducing water or after a short operation at high heat fluxes.

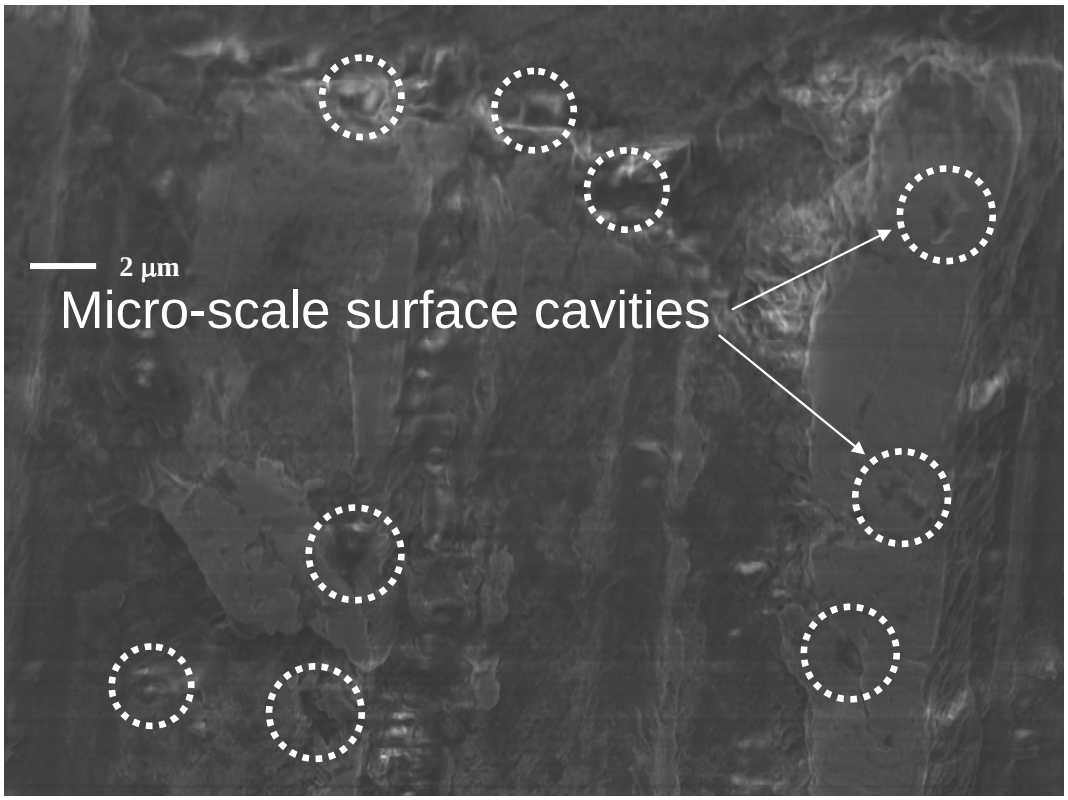

Figure S1. Scanning electron micrograph of the plain Cu surface prior to performing the nanorod depositions.