

Data for: A temporal–spatial framework for efficient heat flux monitoring of transient boiling

Dataset DOI: 10.5061/dryad.6m905qgc7

Description of the data and file structure

This dataset includes the temperature, acoustic (hydrophone), and videos of transient pool boiling tests of water on flat copper surfaces. The pool boiling test facility includes (a) a heating element that consists of a copper block and cartridge heaters; (b) a closed chamber with flow loops for a chiller (Thermo Scientific Polar ACCEL 500 Low/EA) connecting Graham condenser (Ace glass 5953-106) with an adapter (Ace glass 5838-76) and an in-house built coiled copper condenser; and (c) a synchronized multimodal sensing system. The copper block is submerged in deionized water and heated by nine cartridge heaters (Omega Engineering HDC19102), each with a power rating of 50 W, inserted from the bottom. The cartridge heaters are connected to the DC power supply (MagnaPower SL200-7.5) for controlling the heating power. The copper tube coiled condenser is used to keep the vapor pressure in check during the boiling test. This is done by controlling the flow rate passing through it manually using the flow metering valve with a Vernier handle (Swagelok SS-SS4-VH). Two screw-plug immersion heaters (McMaster-Carr 4668T54) are immersed in the liquid pool for degassing and auxiliary heating. A variable-voltage transformer (McMaster-Carr 6994K17) is used for adjusting the voltage required for the immersion heaters within the given range. The test facility is installed on a Thorlab Nexus optical table (T46V) with passive legs (PTP703) for vibration isolation.

Files and variables

File: ned3-006_BoilingImageSequence.zip

Description: This zip file includes eleven folders, i.e., Boiling-87, Boiling-89, Boiling-90, Boiling-91, Boiling-92, Boiling-93, Boiling-94, Boiling-96a, Boiling-96b, Boiling-96c, and Boiling-96d. Each folder, labeled with a test ID, Boiling-xxx, includes three files:

- The Boiling-xxx_Temperature.lvm includes the temperature measurements using probe thermocouples (Omega Engineering Tj36-CPSS-032U-6) in the copper block and pool thermocouples in the water and vapor phases (McMaster-Carr 1245N16). These data are collected using an NI-9210 module.
- The Boiling-xxx_Hydrophone.lvm file includes the continuously sampled acoustic data using two HTI-96-MIN hydrophones with an NI-9230 module.
- The Boiling-xxx_video.mp4 file is a video for the boiling test. The original video (.cine) was captured using a Phantom VEO 710L high-speed camera. The .mp4 file was converted from the .cine file using the Phantom Camera Control (PCC) software (<https://www.phantomhighspeed.com/resourcesandsupport/phantomresources/pccsoftware>).

Code/software

- The .txt and .lvm files can be opened and analyzed using programming languages such as Python and MATLAB. They can also be opened using Excel, Notepad, or other sheet or text readers.
- The .mp4 file can be opened using a video player.