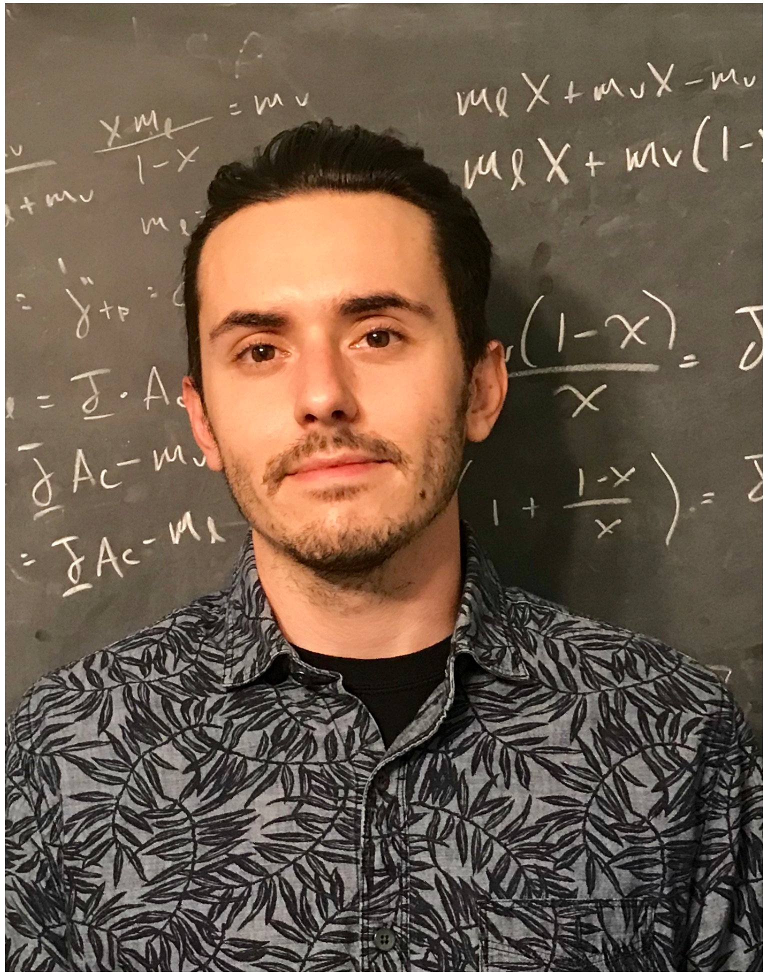

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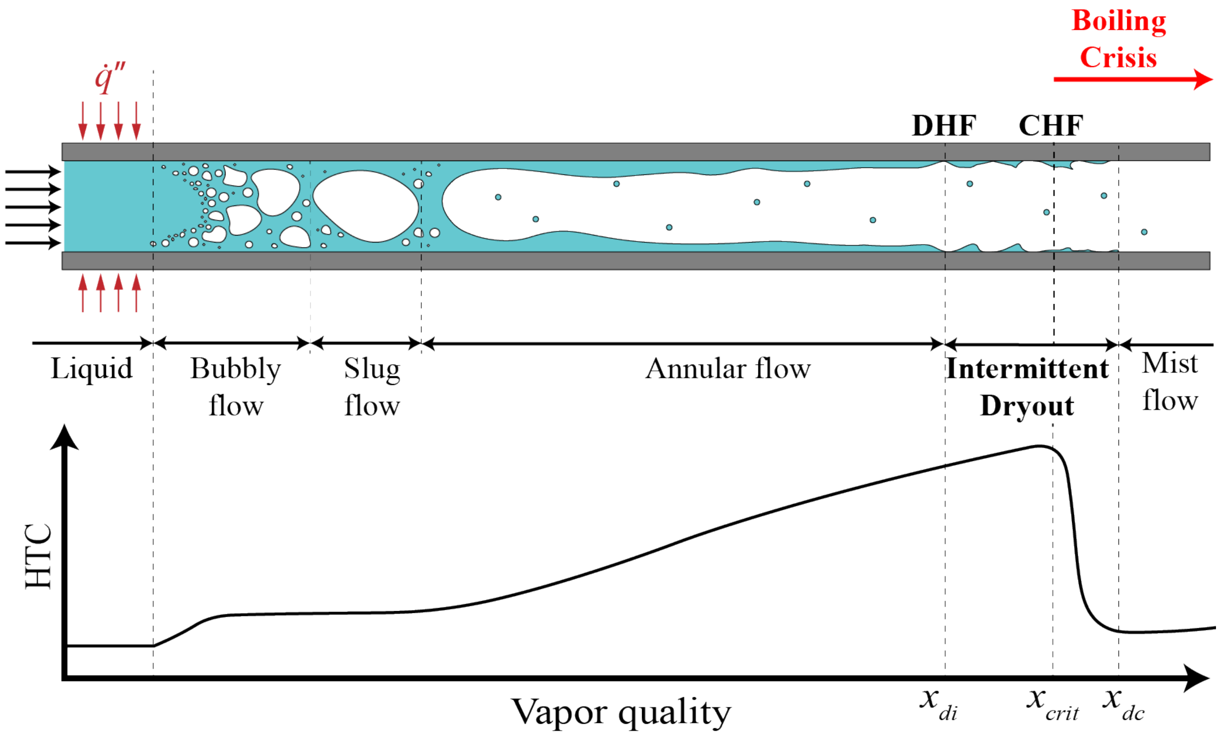
Critical heat flux and liquid-film dryout in two-phase annular flow

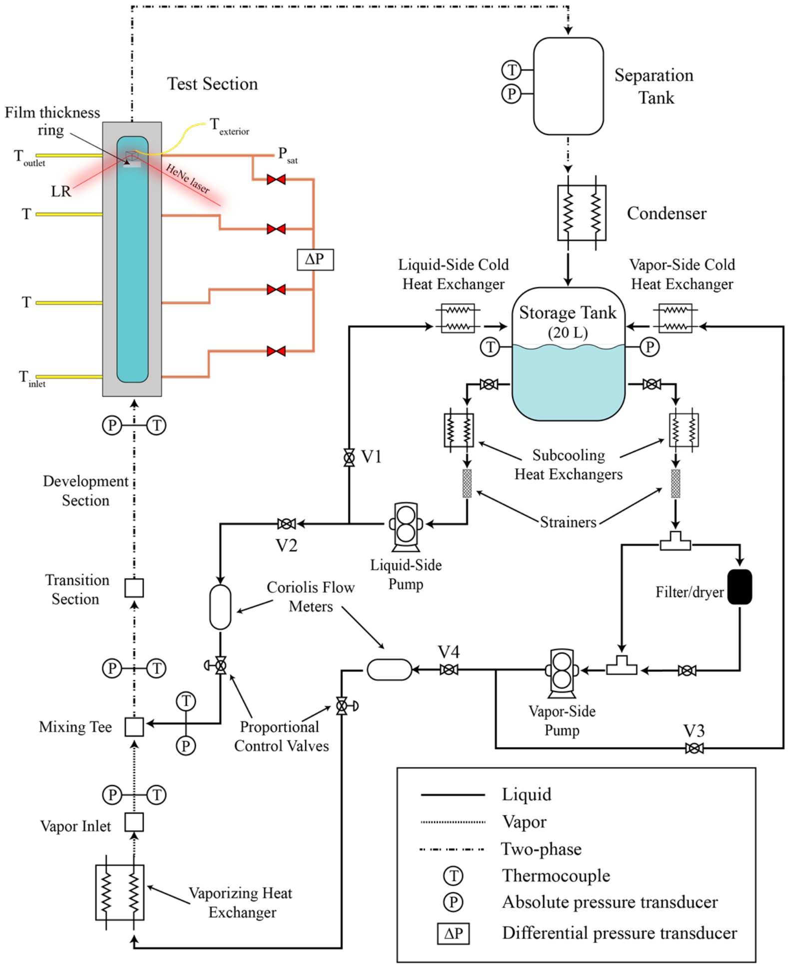
Description



- In flow boiling systems, a saturated fluid progress through a series of flow regimes as energy is added from a heated surface (seen in the schematic as moving from left to right).
- The local heat transfer coefficient (HTC) reaches a maximum value in the annular flow regime (seen in the bottom plot). The annular regime is characterized with a vapor core and liquid film on the heated surface.
- For a given mass flux and vapor quality, there exists a heat flux vaporizes all of the local liquid film; this is called dryout. The heat flux at which dryout first occurs is the dryout heat flux (DHF)
- The heat flux at which the maximum HTC occurs is the critical heat flux (CHF). Exceeding CHF results in reduced HTC.

Morse et al., Critical heat flux and the dryout of liquid film in two-phase annular flow, Int. J. Heat Mass Transfer 177 (2021) 121487

Experimental



Morse et al., Critical heat flux and the dryout of liquid film in two-phase annular flow, Int. J. Heat Mass Transfer 177 (2021) 121487

- The MFVAL investigates flow boiling experimentally. A schematic of the facility is shown on the left. The working fluid in the experiment is R245fa, a low-pressure refrigerant that possesses similar physical properties when compared to high-pressure steam.
- The test section is made from glass windows which are coated with an oxide layer that is used to provide heat flux at the liquid-glass interface.
- Time-averaged process conditions such as temperature, pressure, vapor quality, local heat transfer coefficient are measured.
- Time-resolved measurements are made for liquid-film thickness and wet/dry state during dryout and rewet cycles.
- The combination of the time-averaged process conditions and time-resolved local measurements are used to extract information about the physics that govern the liquid-film dryout process.