

BOOST: Boiling Optimization of Eco-Friendly Refrigerants with Surface Engineering Technology

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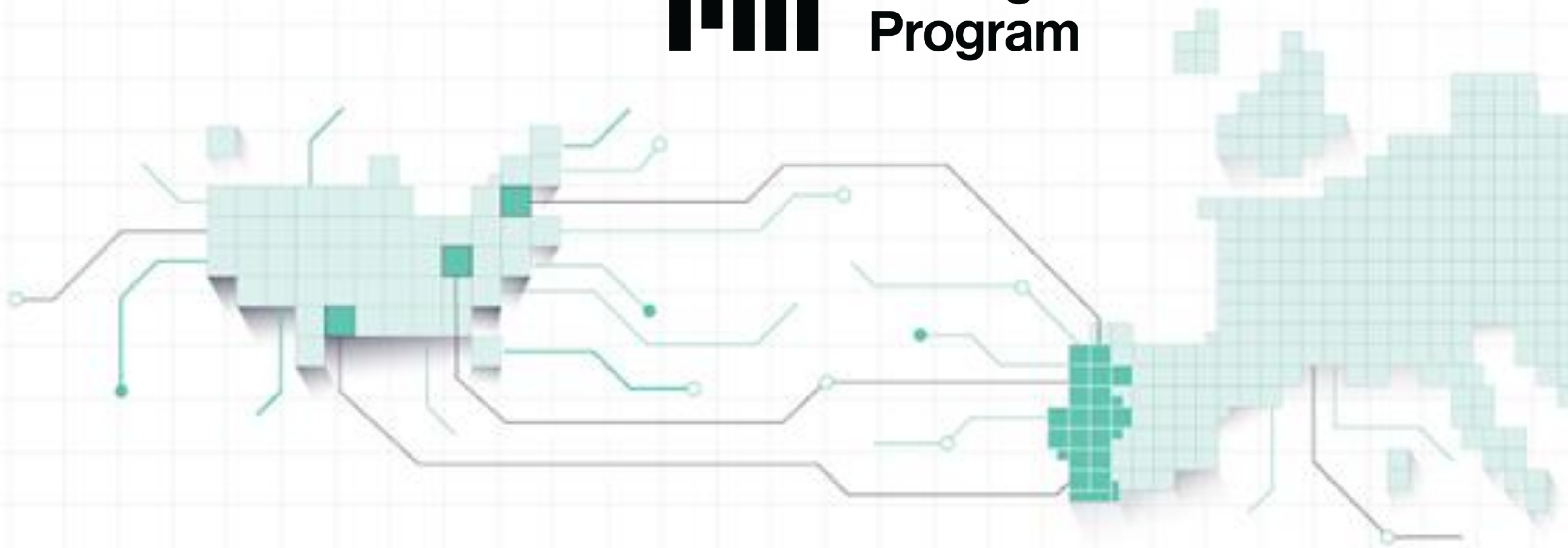


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From Knowledge
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Portugal-US Partnerships 2026 Summit

MIT Portugal
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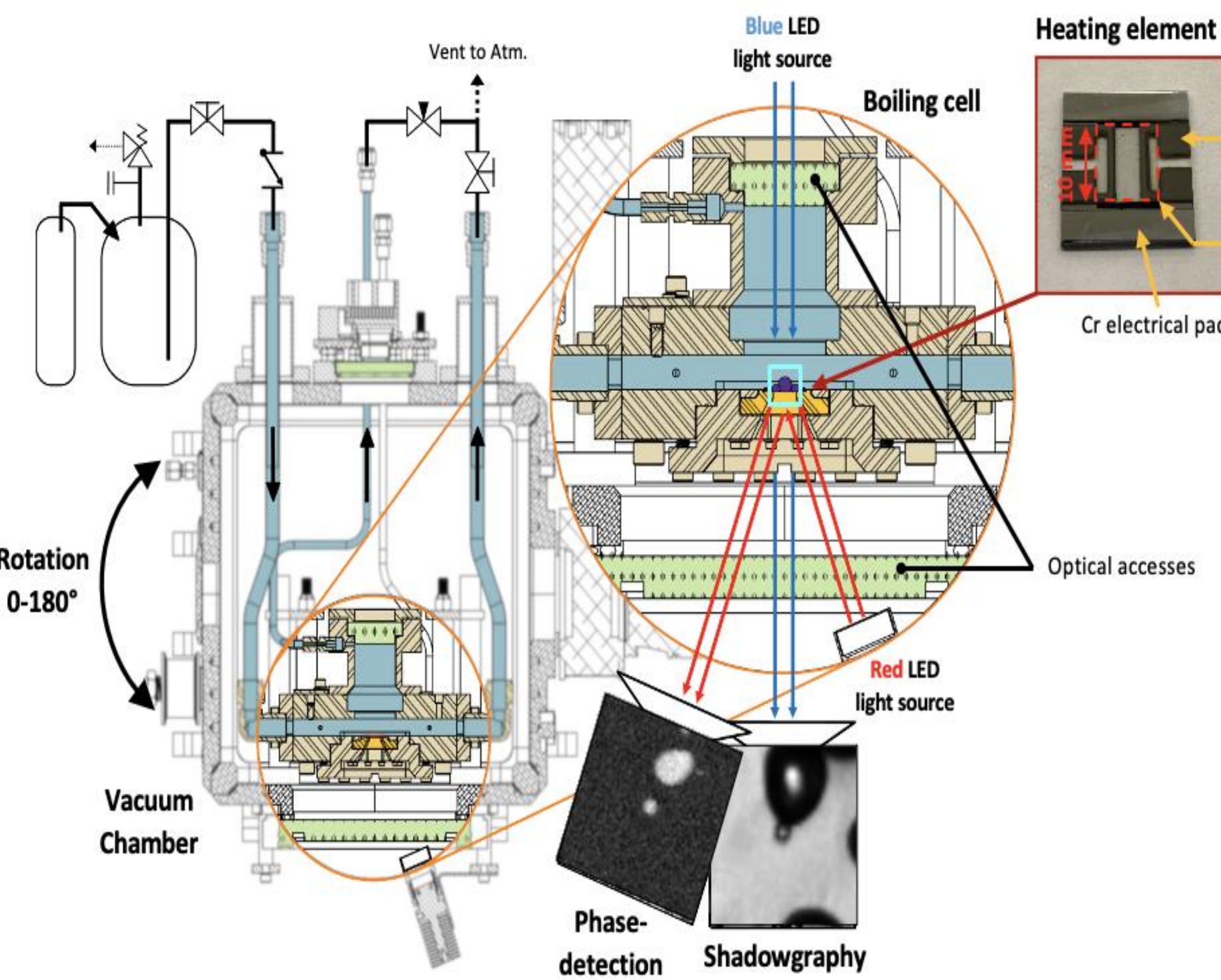


OBJECTIVES

This project aims to develop cleaner, more efficient heating and cooling technologies by improving eco-friendly refrigerants boil using specially engineered surfaces. Researchers at MIT and the Universidade de Lisboa will combine advanced infrared and optical diagnostics with custom-designed materials to maximize heat transfer. These breakthroughs could reduce greenhouse gas emissions from heat pumps, refrigeration, and solar power generation systems. The results will support scalable, sustainable thermal systems for industrial and residential use.

EXPERIMENTAL APPROACH

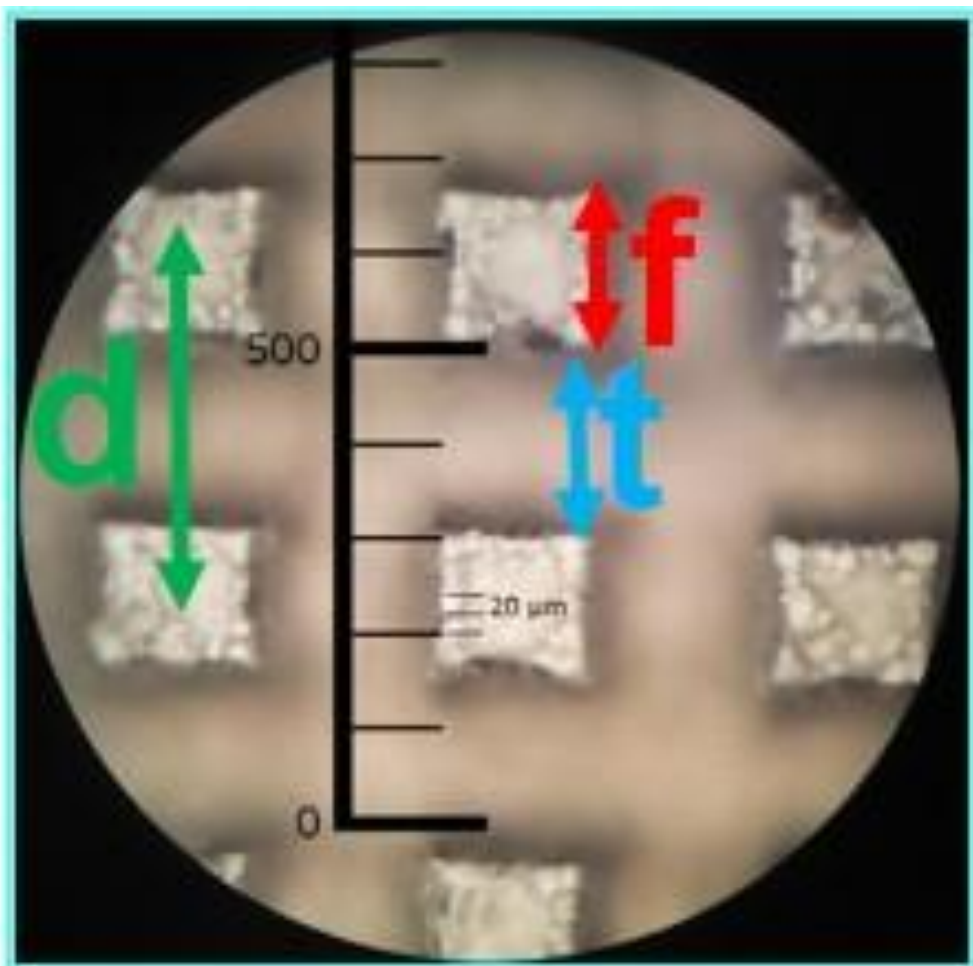
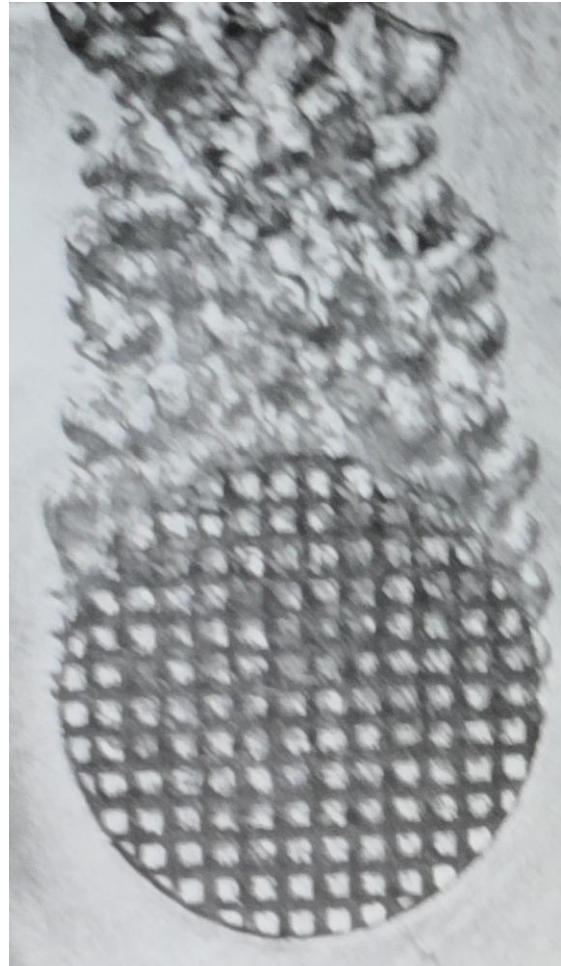
Develop of engineered fluids and micro-nano-enhanced interfaces to improve heat and mass transport.



IMPACT

Project directly related to a Portuguese exploratory project, which includes industrial partners - will benefit from the outcomes of the project proposed here, namely on the effective integration of eco-friendly refrigerants in cooling systems based on microgeometries. High impact on the Portuguese industry, as the industrial partners will directly benefit from the possible future implementation of these cooling solutions in their systems.

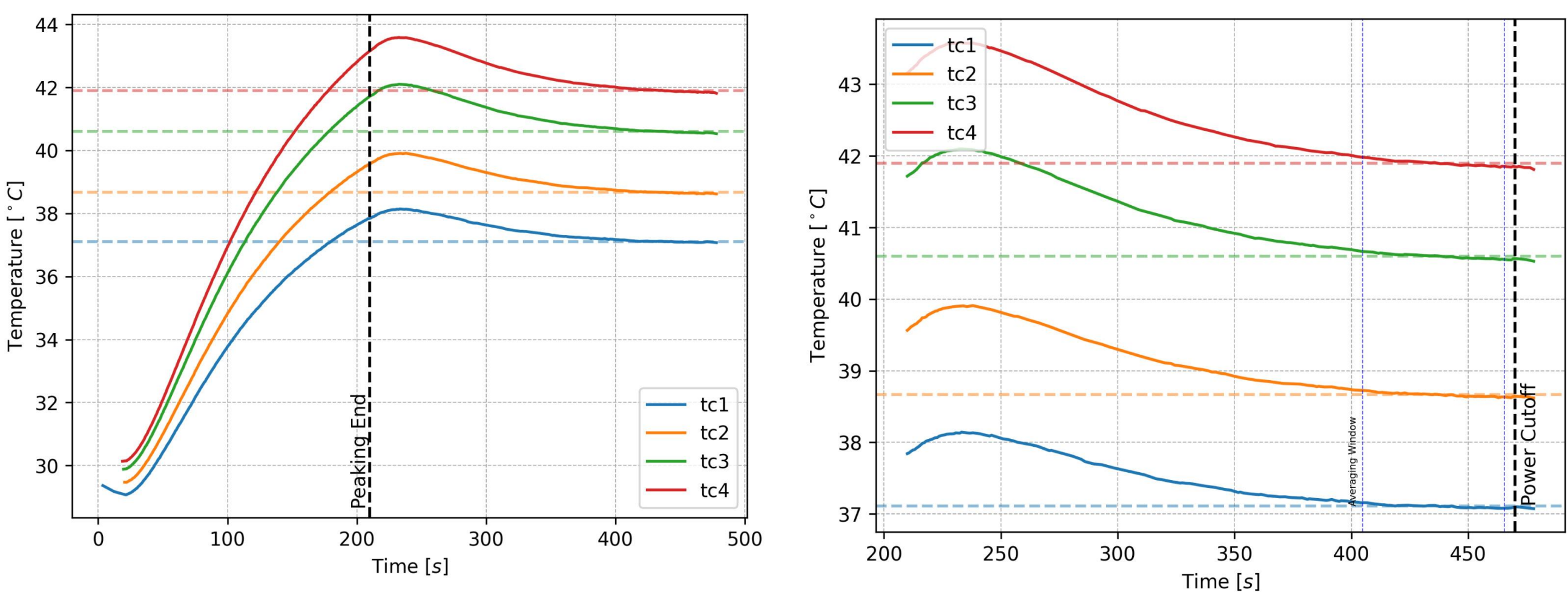
Surface:	H100	P100	W100	H300	P300	W300
Feature dimension (μm)	107.5	42.5	27.5	230	170	162.5
Thickness between features (μm)	12.5	77.5	92.5	140	200	212.5
Distance between feature centers (μm)	120	120	120	370	370	375



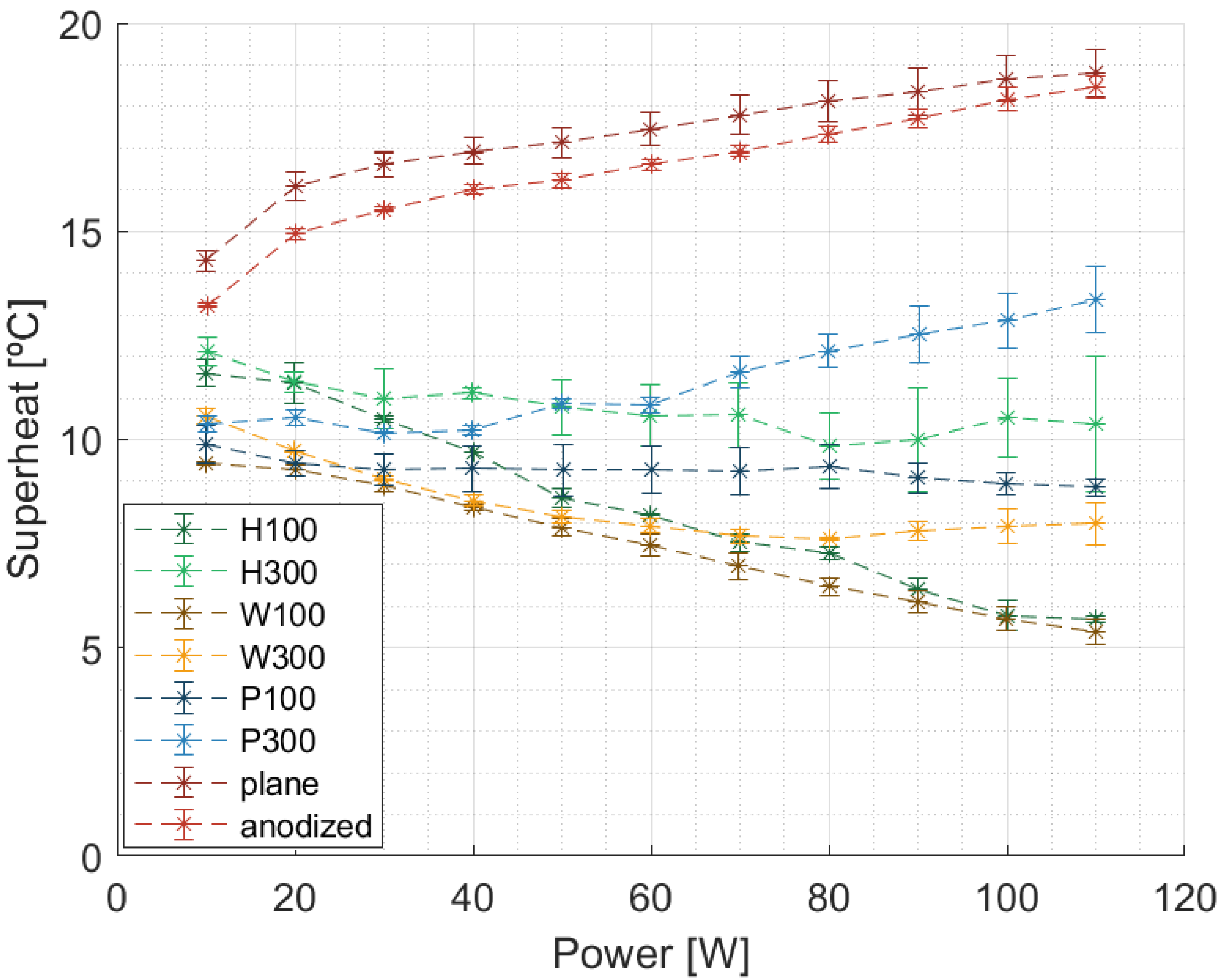
MIT Seed Calls 2025
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SAMPLE RESULTS

Pool boiling curves obtained for ambient and high pressure (7bar) conditions using refrigerant fluid on aluminum microstructured surfaces.



Sample boiling curve obtained with an aluminum microstructured surface with micro-pillars (P300) at 7 bar



Boiling curves obtained with various aluminum microstructured surfaces at atmospheric pressure

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