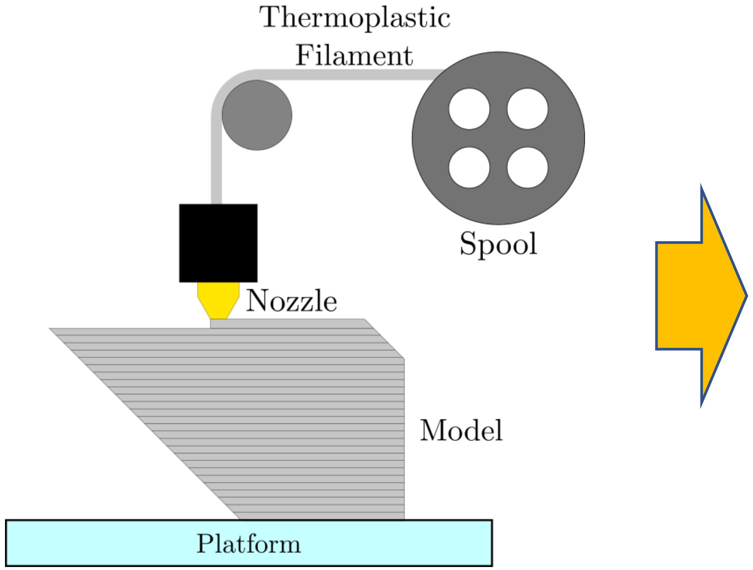
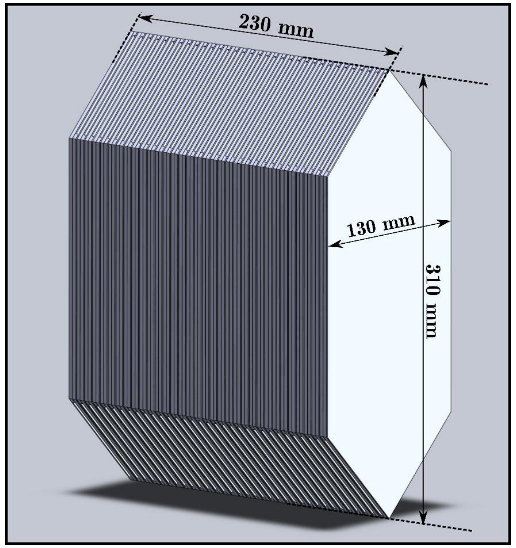
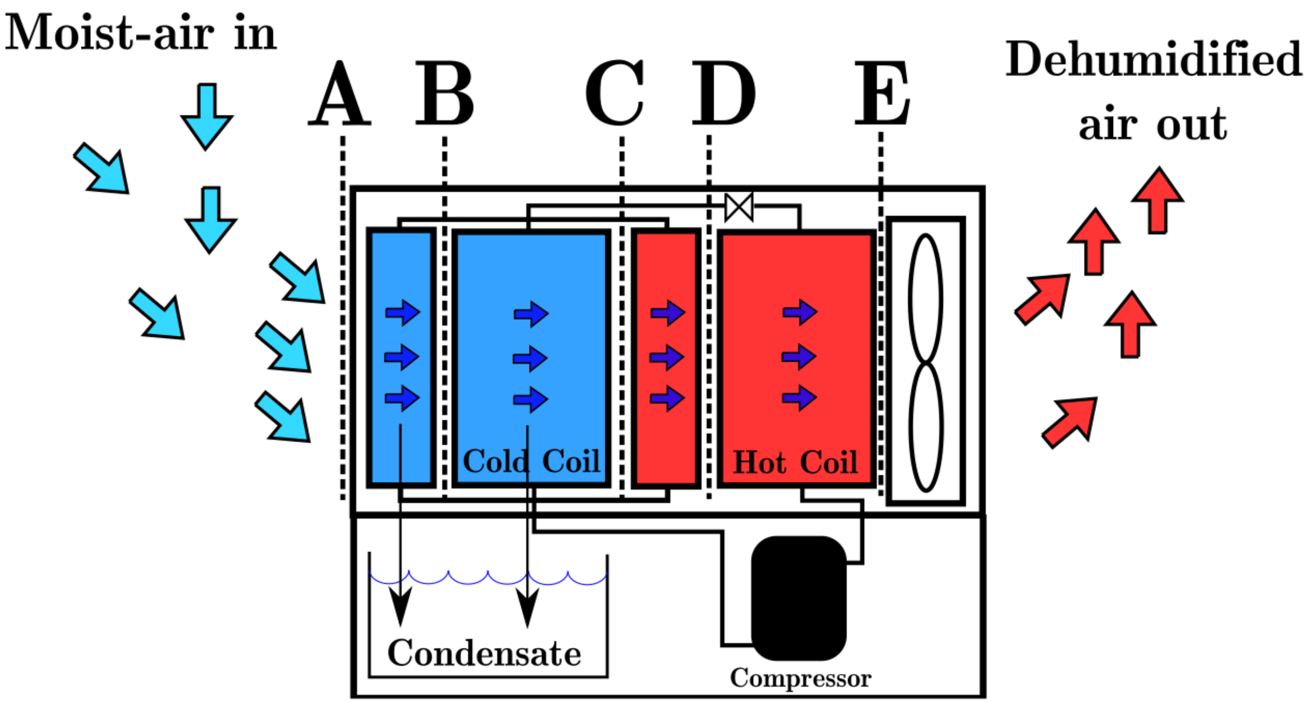
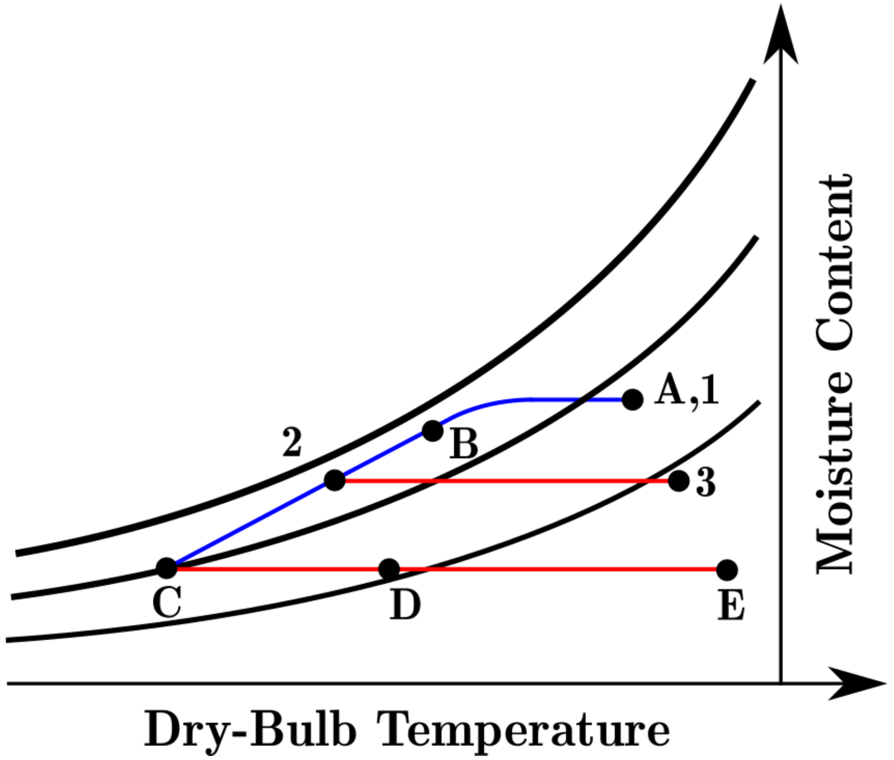
# Refrigerative Dehumidifier Research



# Background



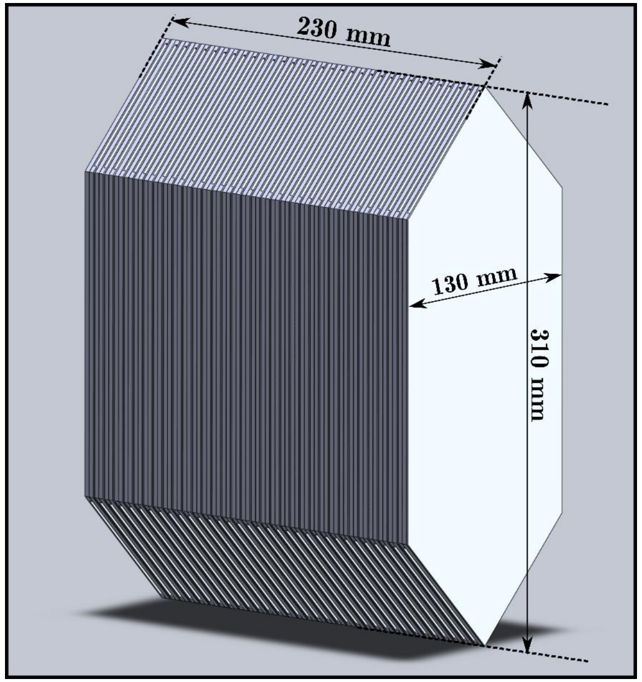




$$MER_{EC} \sim 26\% \; MER_{TOTAL}$$

Lowrey, S., Le Bonniec, G. and Sun, Z., 2019. Fluid flow modulation in a domestic refrigerative dehumidifier with air-side gearing. *International Journal of Refrigeration*, *106*, pp.258-265.

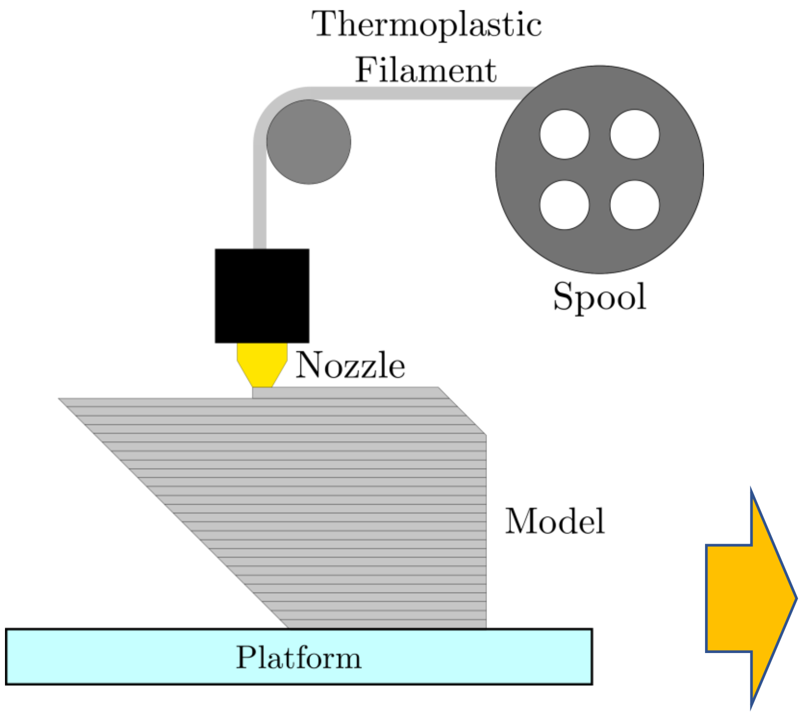
# Plate Heat Exchanger

## PHE design




- Duct width = 2 mm; duct height = 85 mm.
- Aluminium/PLA wall thickness: 1 mm
- 66 ducts (33 on HS, 33 on CS).

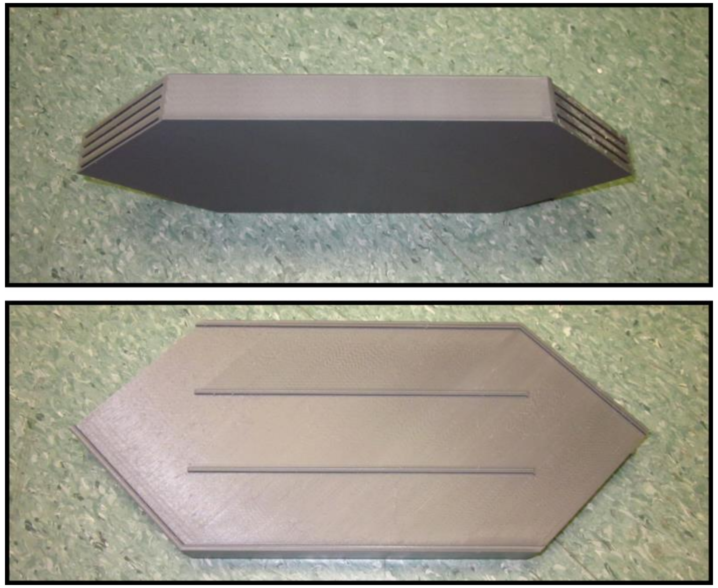
## Fabrication




**Polymer benefits: lighter; low-cost.**

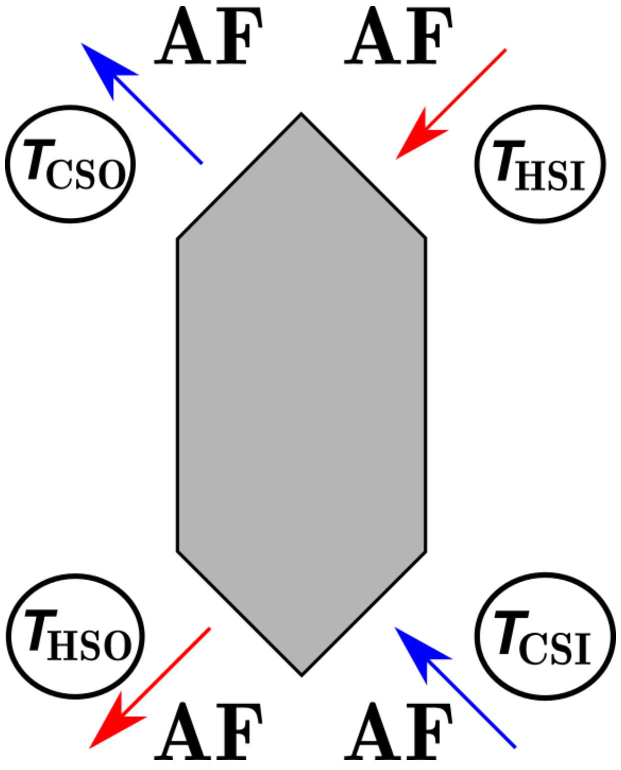
## Metal PHE (Control)

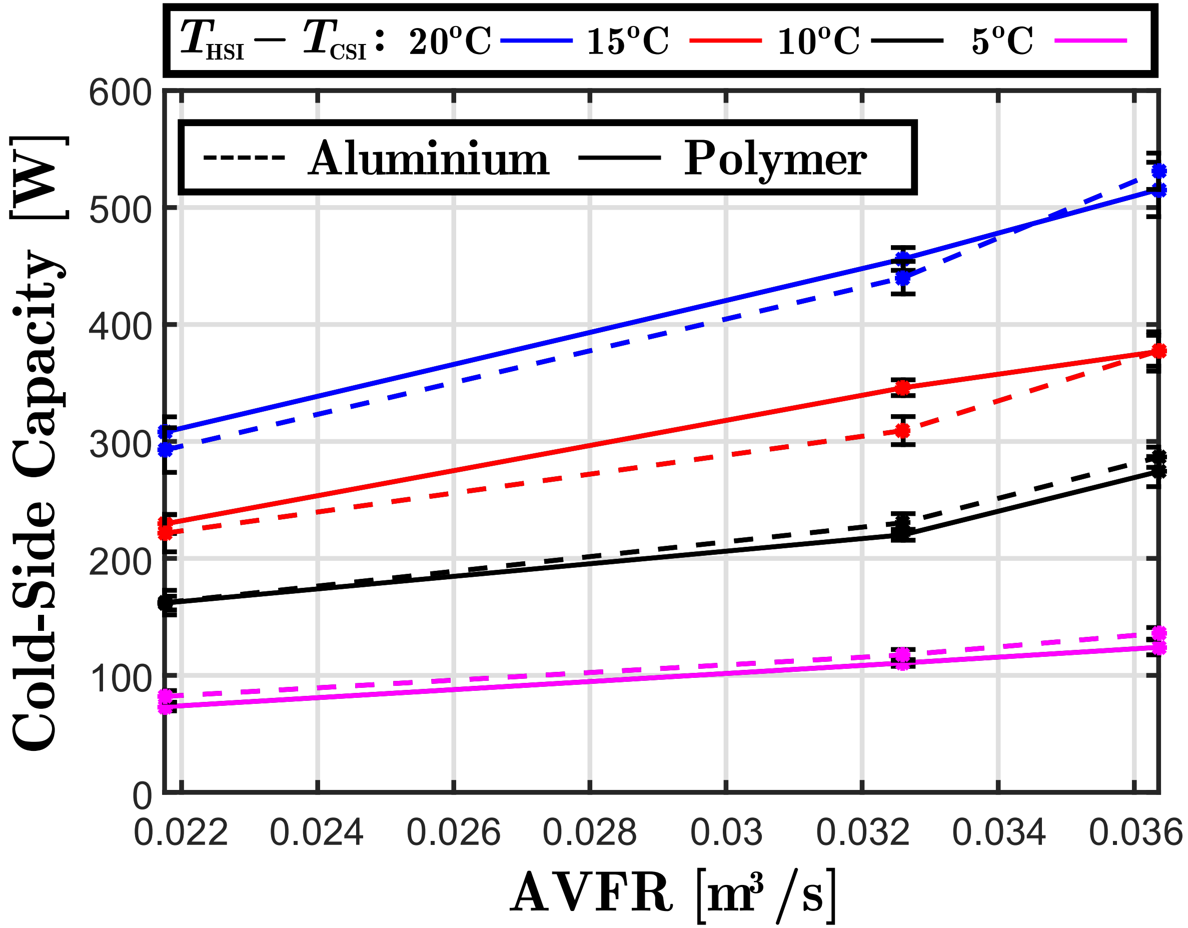
## Polymer (PLA) PHE part



# PHE - Dry Operating Conditions

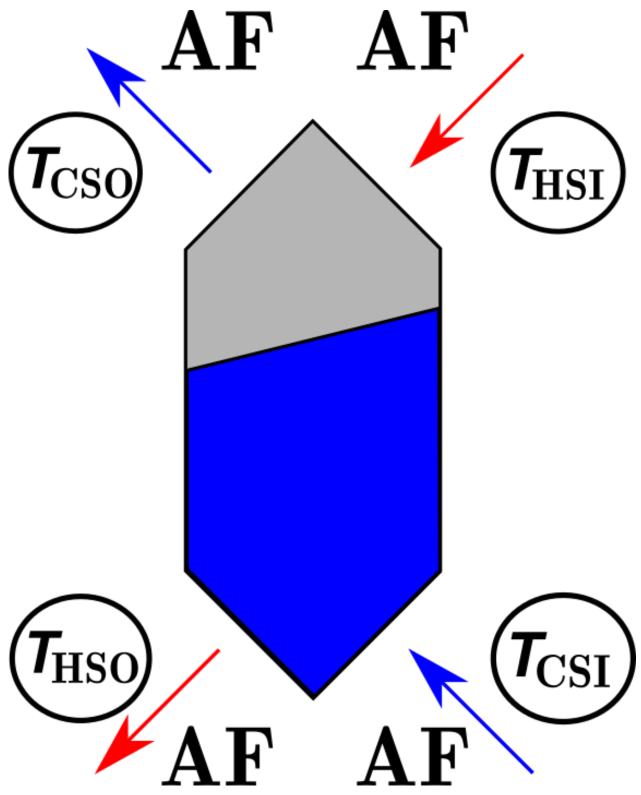
**$RH_{HSI}$ = 60% in all tests.**

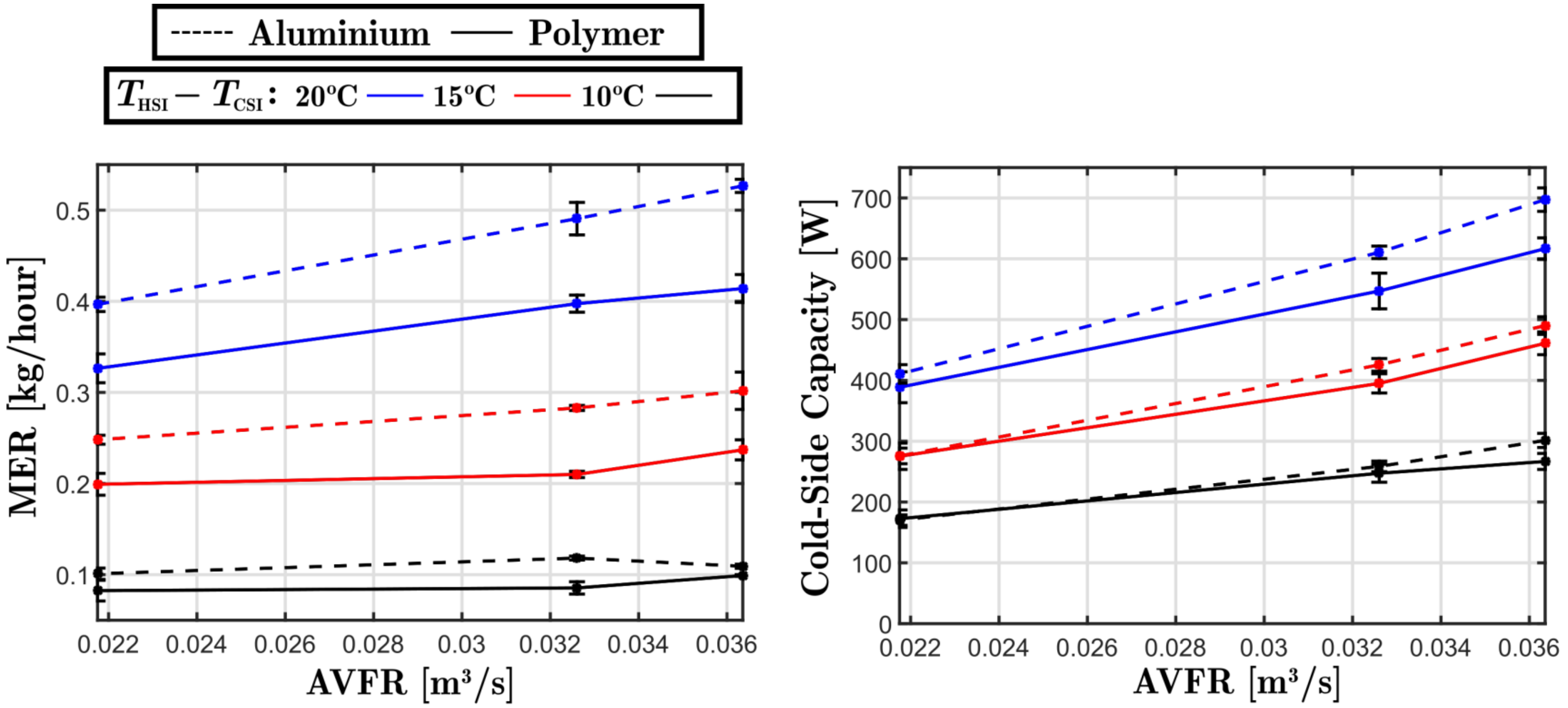



Lowrey, S., Hughes, C. and Sun, Z., 2021. Thermal-hydraulic performance investigation of an aluminium plate heat exchanger and a 3D-printed polymer plate heat exchanger. *Applied Thermal Engineering*, *194*, p.117060.

# PHE - Wet Operating Conditions

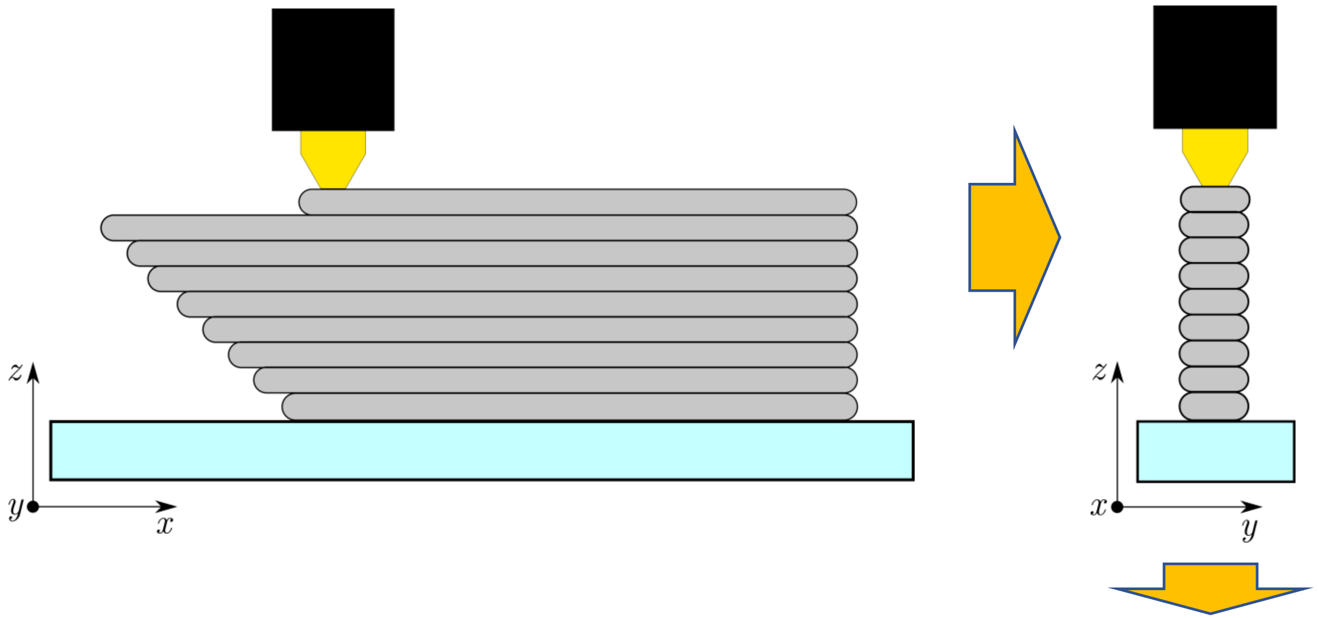


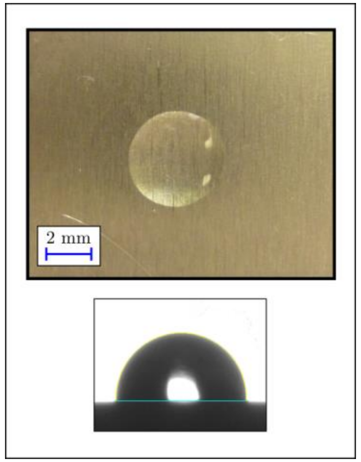




**RH$_{HSI}$ = 80% in all tests.**

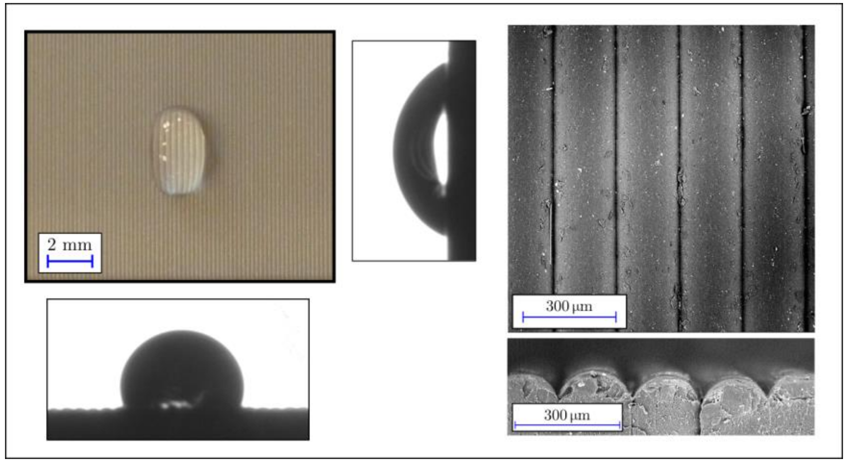
Lowrey, S., Hughes, C. and Sun, Z., 2021. Thermal-hydraulic performance investigation of an aluminium plate heat exchanger and a 3D-printed polymer plate heat exchanger. *Applied Thermal Engineering*, *194*, p.117060.

# 3D Printed Surfaces - Micropatterns



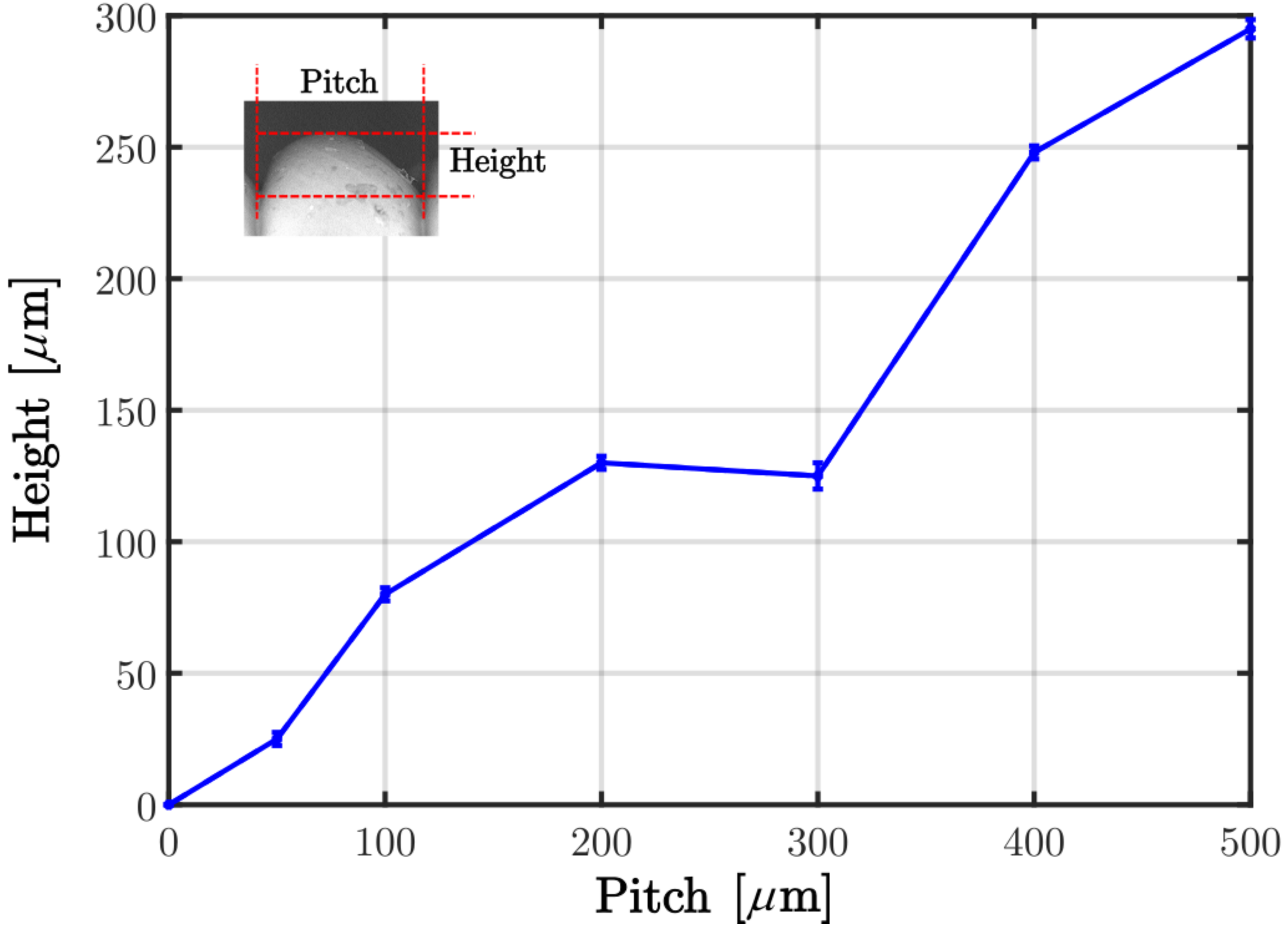

**Aluminium**

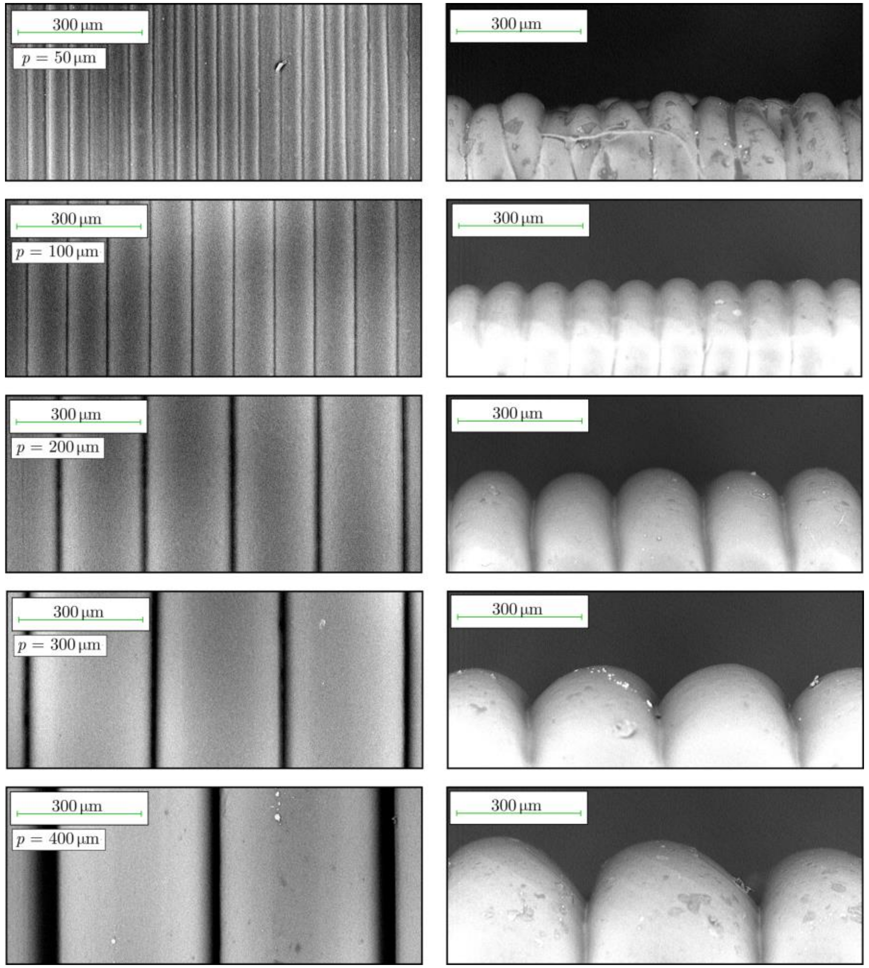



**Polymer**

Lowrey, S., Hughes, C. and Sun, Z., 2021. Thermal-hydraulic performance investigation of an aluminium plate heat exchanger and a 3D-printed polymer plate heat exchanger. *Applied Thermal Engineering*, *194*, p.117060.

# 3D Printed Surfaces – SEM Imaging



# Conclusions

- Polymer PHE has lower condensing performance than aluminium control.
- Polymer PHE has shown improvements in dehumidifier air-side gearing.
- 3D-printing provides periodic microstructure. May help improve wet PHE performance.

## FUTURE WORK

- Optimise 3DP surface for maximum water shedding.
- Test 3DP PHE for improved water shedding.
- Revisit geared dehumidifier and retest with improved polymer PHE.