Comparison of Convective Heat Transfer Characteristics of Supercritical Fluid for Circular-Pipes in Horizontal Flow

Supercritical CO_2 Power Cycles Symposium

Paper 125

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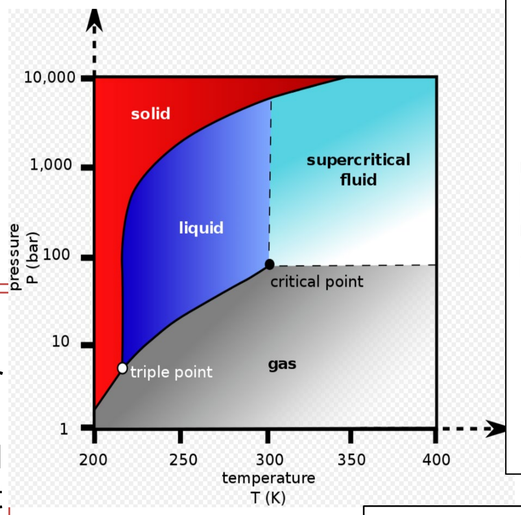
INTRODUCTION

Supercritical carbon dioxide (sCO_2) research offers promising contribution to various applications-

- Power generation
- Heat exchangers
- Aviation
- Biomedical materials
- Heating, Ventilation and
- Air conditioning systems etc.

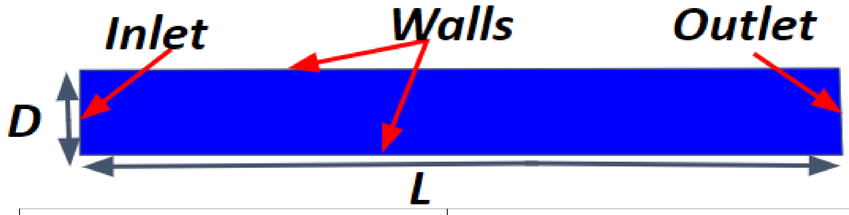


Ref: Carbon dioxide P-T phase diagram by Ben Finney and Mark Jacobs

MOTIVATION

- Explore the efficacy of sCO2 for heat exchangers
- Comparison of computational and analytical predictions of sCO2 heat transfer characteristics.

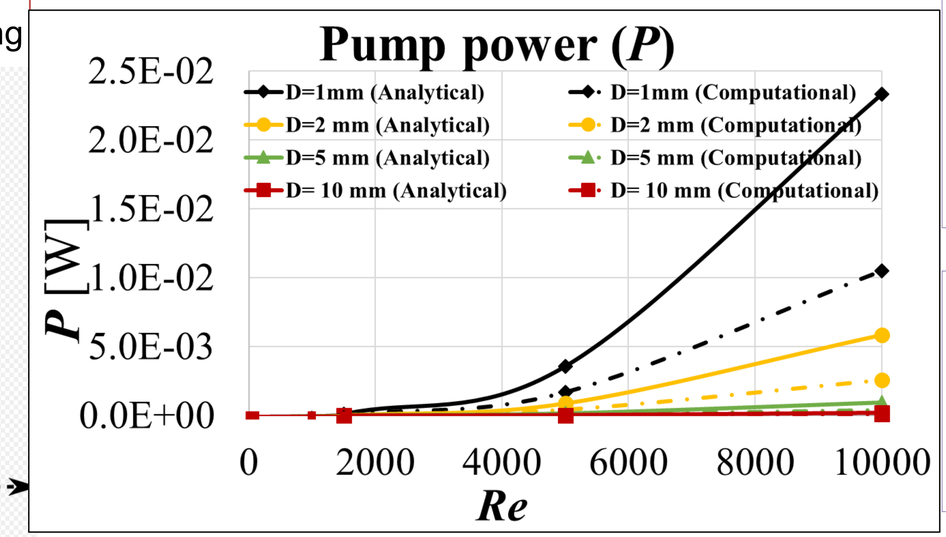
METHODOLOGY



Diameter (D)	1,2,5 and 10 [mm]
Length (L)	1[m]

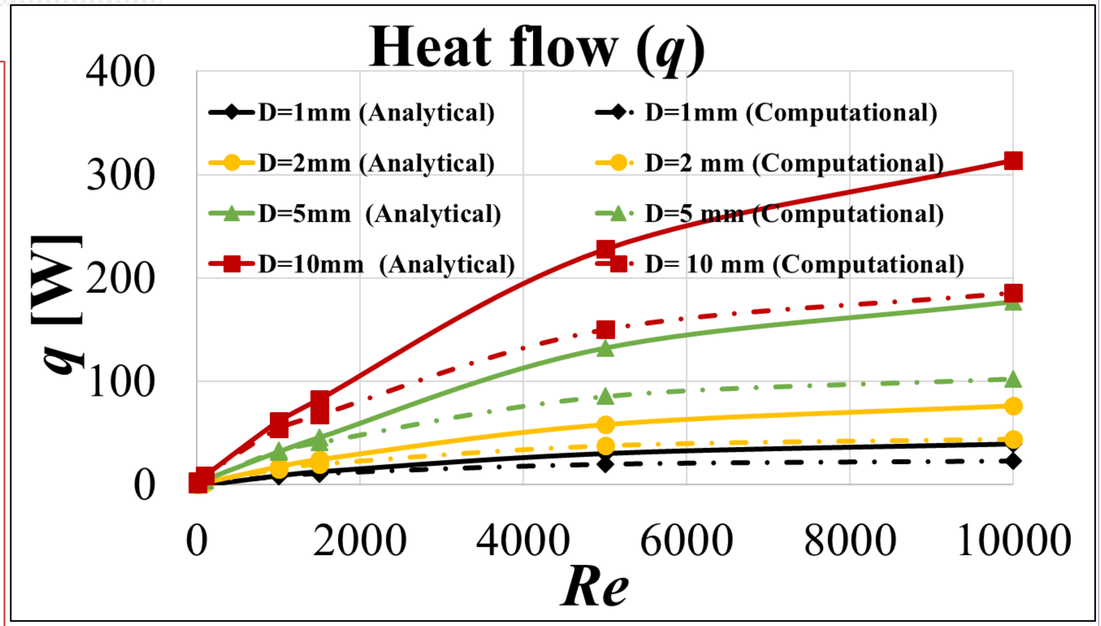
Re	*10, 100, 1000, 1500, 5000, 10 000*
P_r	*1.1*
T_r	*1.64*
T_{inlet}	*700 [K]*
T_∞	*300 [K]*
h_o	*43.2 [W/m²K]*

RESULTS



Pump power ↑ as Pipe Diameter ↓ and Reynolds number ↑

Ratio of analytical to computational prediction is 2:1



Heat Flow ↑ as Pipe Diameter ↑ and Reynolds number ↑

Ratio of analytical to computational prediction is 2:1

CONCLUSION

Analytical prediction was twice the computational prediction due to geometrical simplification error of the 2D assumption used in the computational simulation

Acknowledgements

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