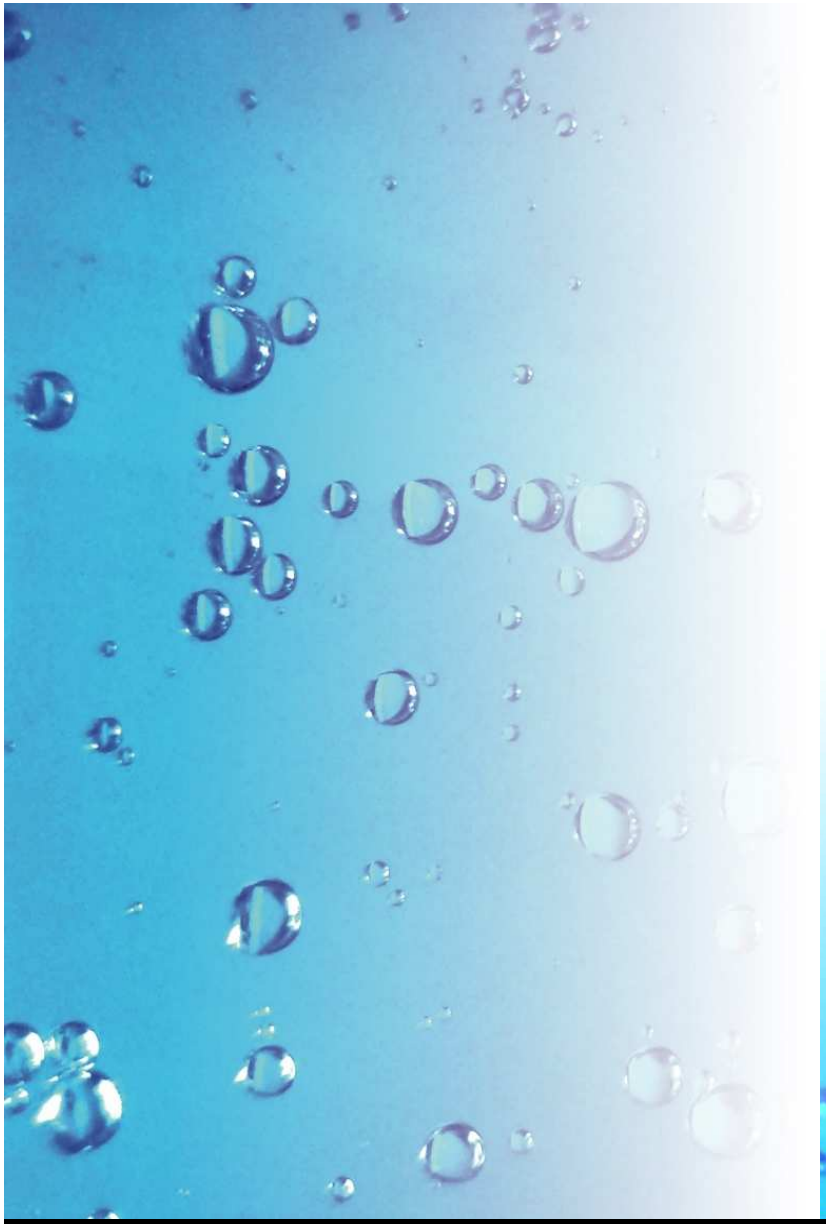

EXPERIMENTAL STUDY OF FLUID FLOW IN MICROCHANNEL

Xi Lu and A. G. Agwu Nnanna
Micro- & Nano-scale Heat Transfer Laboratory
Department of Mechanical Engineering
Purdue University Calumet

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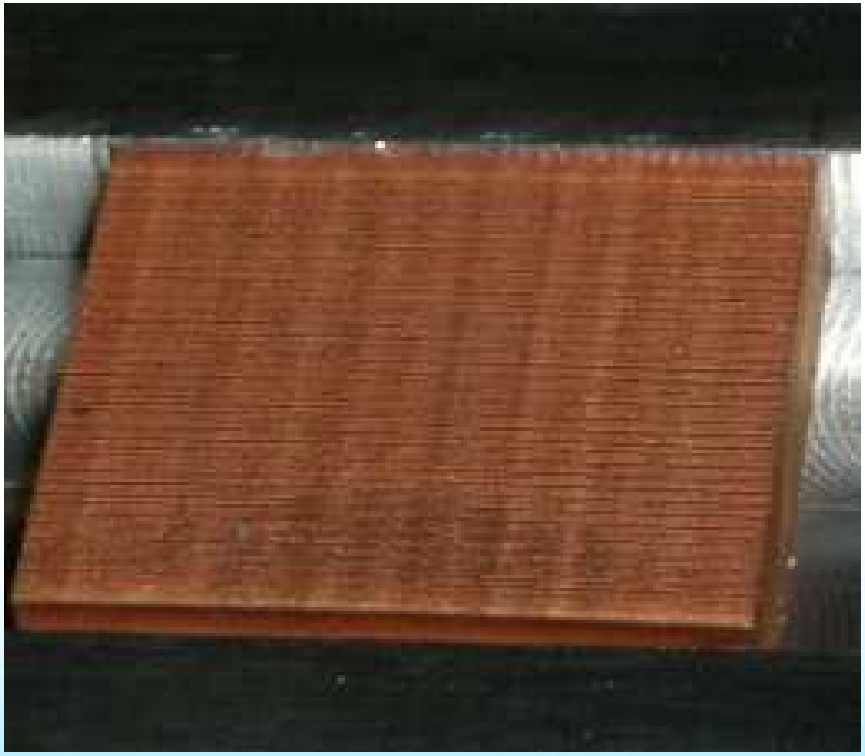

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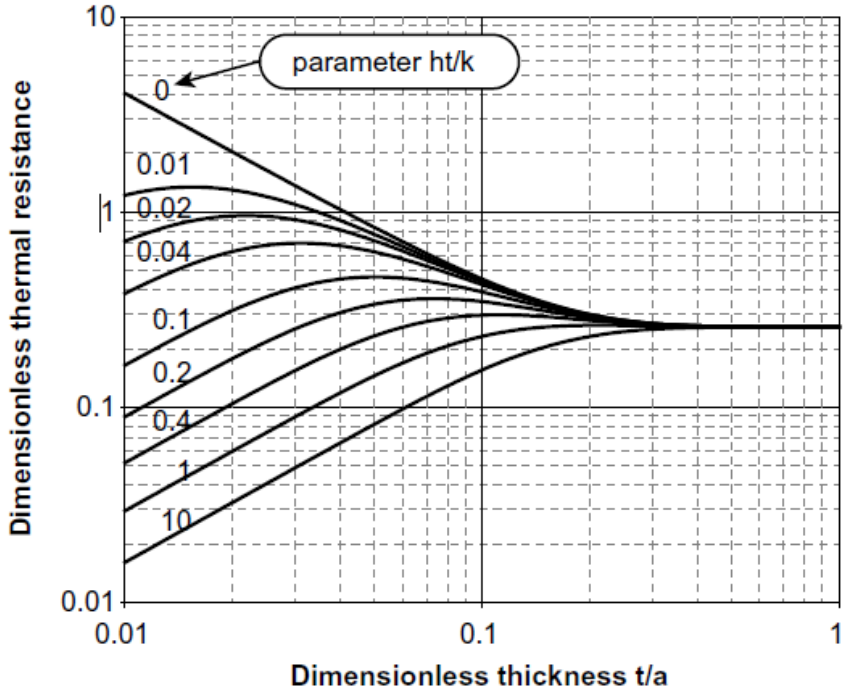
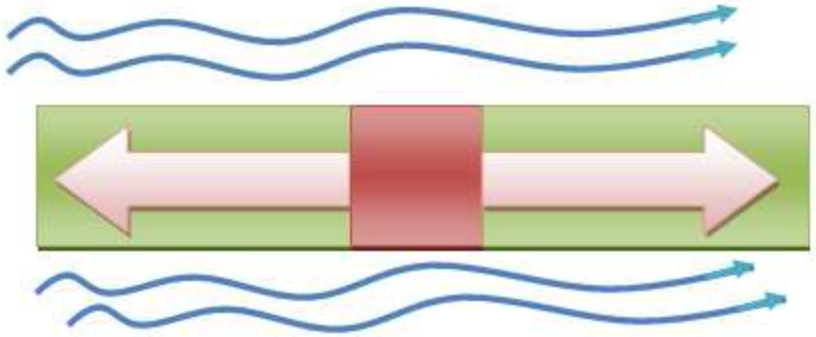
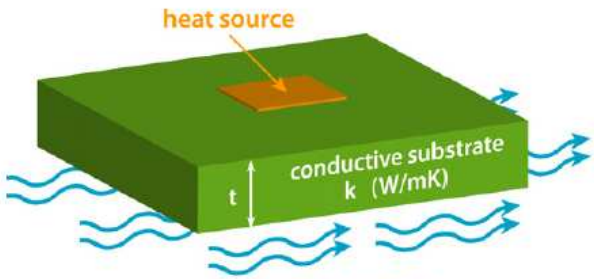


Fig. 1. Typical design curves for conductive and convectively cooled substrate.





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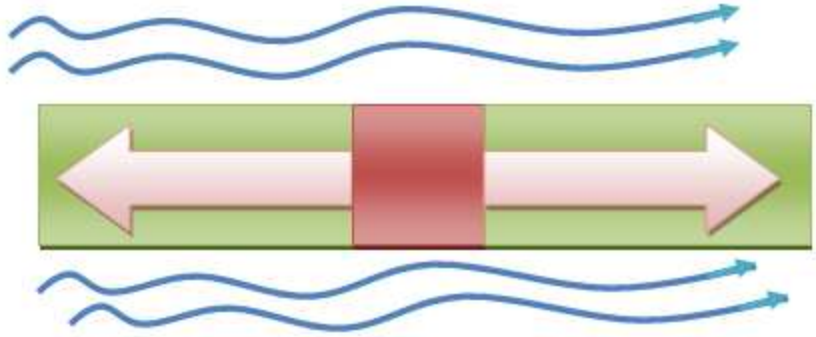

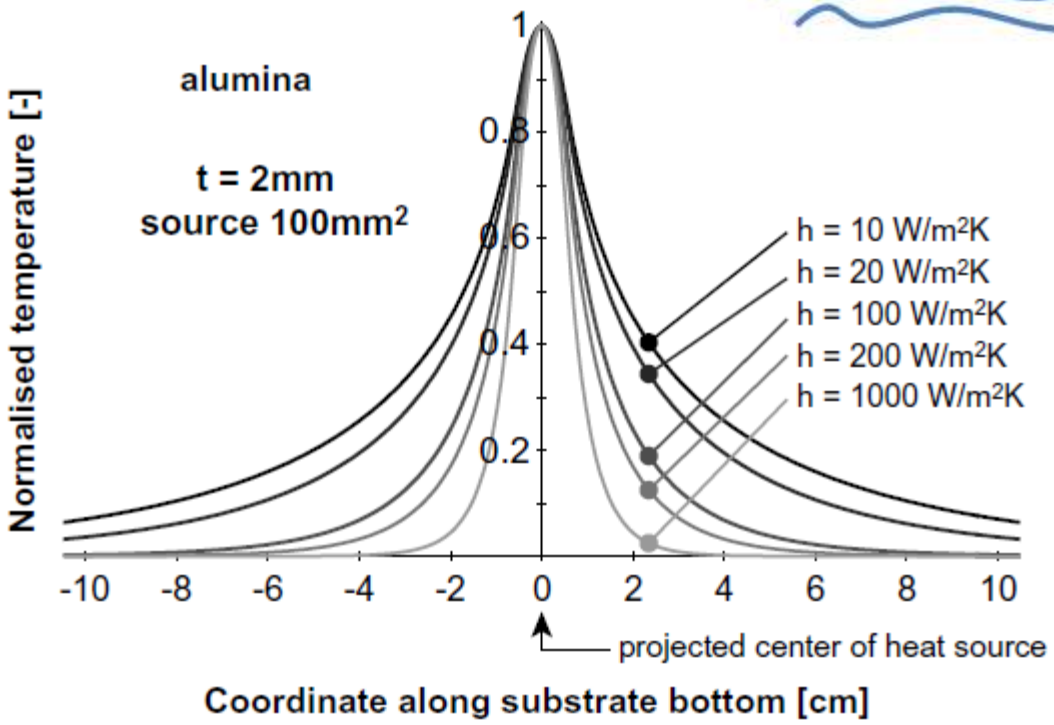

Fig. 8. Exemplary normalised temperature profiles at the bottom of the substrate.

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Statement of Purpose

- Existing studies in literature hypothesizes
  - symmetrical thermal spreading on the substrate
  - One-dimensional Longitudinal wall conduction in the substrate
- To what extent are these hypothesis valid

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Statement of Purpose

- Investigation of
  - Nanoparticle-microchannel wall interaction
  - Impact of heat transfer coefficient on longitudinal and transverse wall conduction

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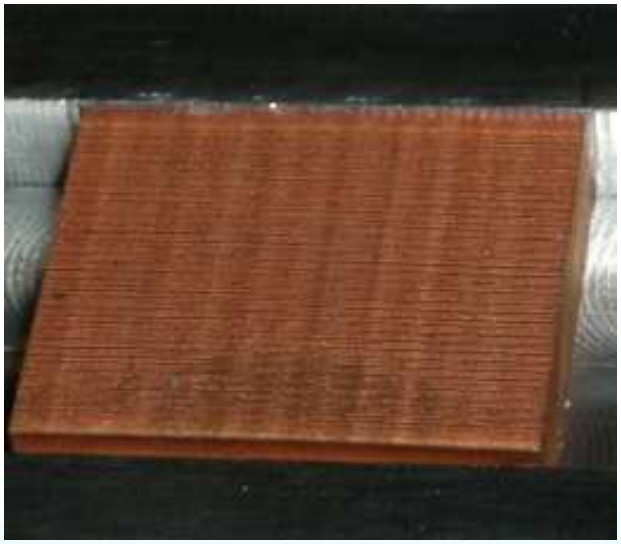
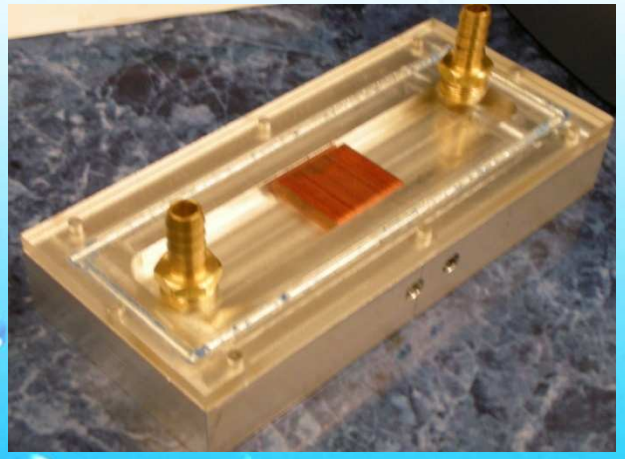
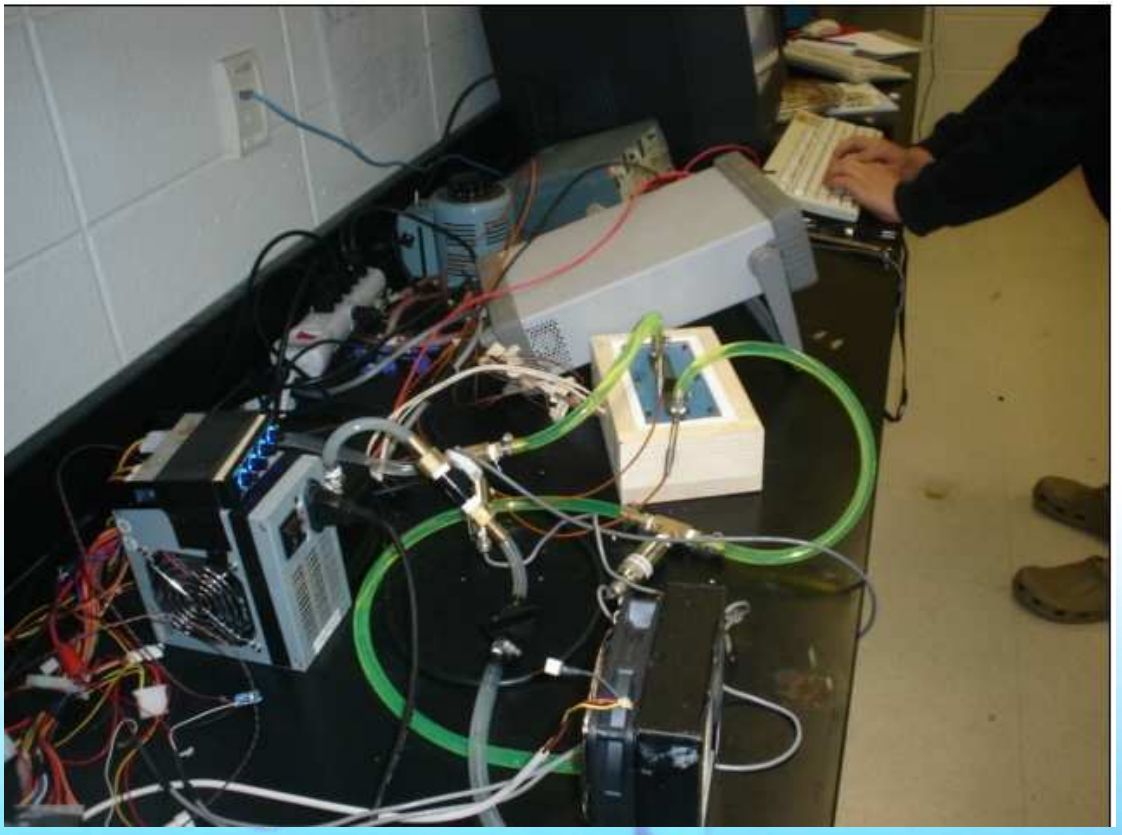
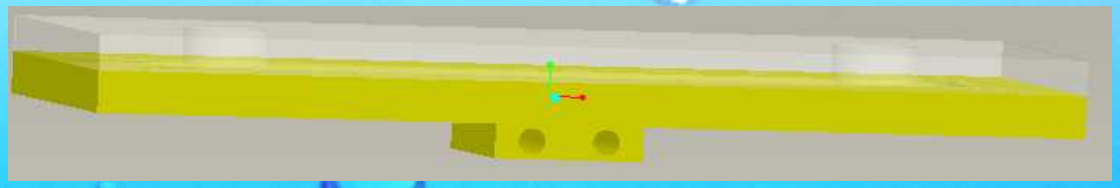
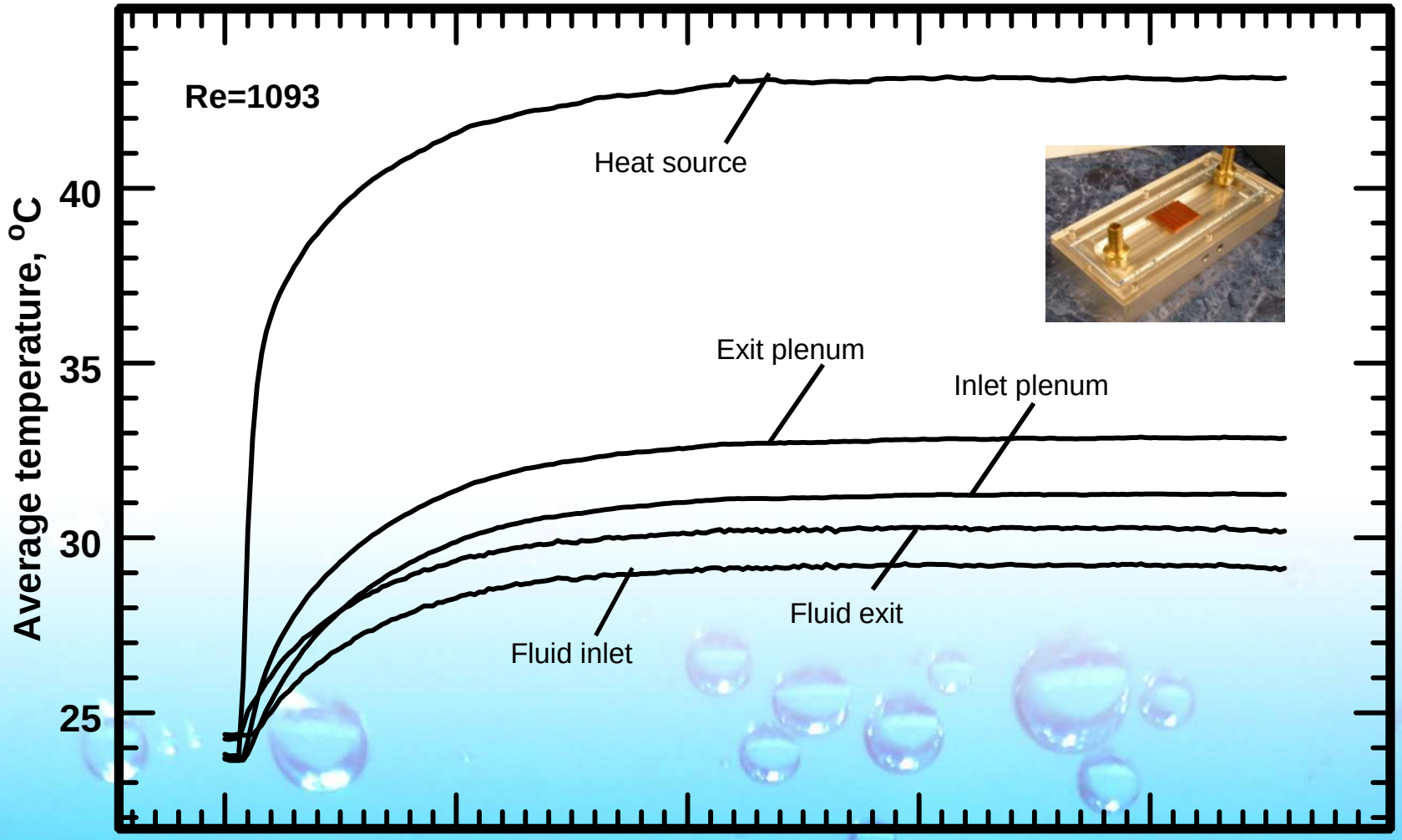
Apparatus











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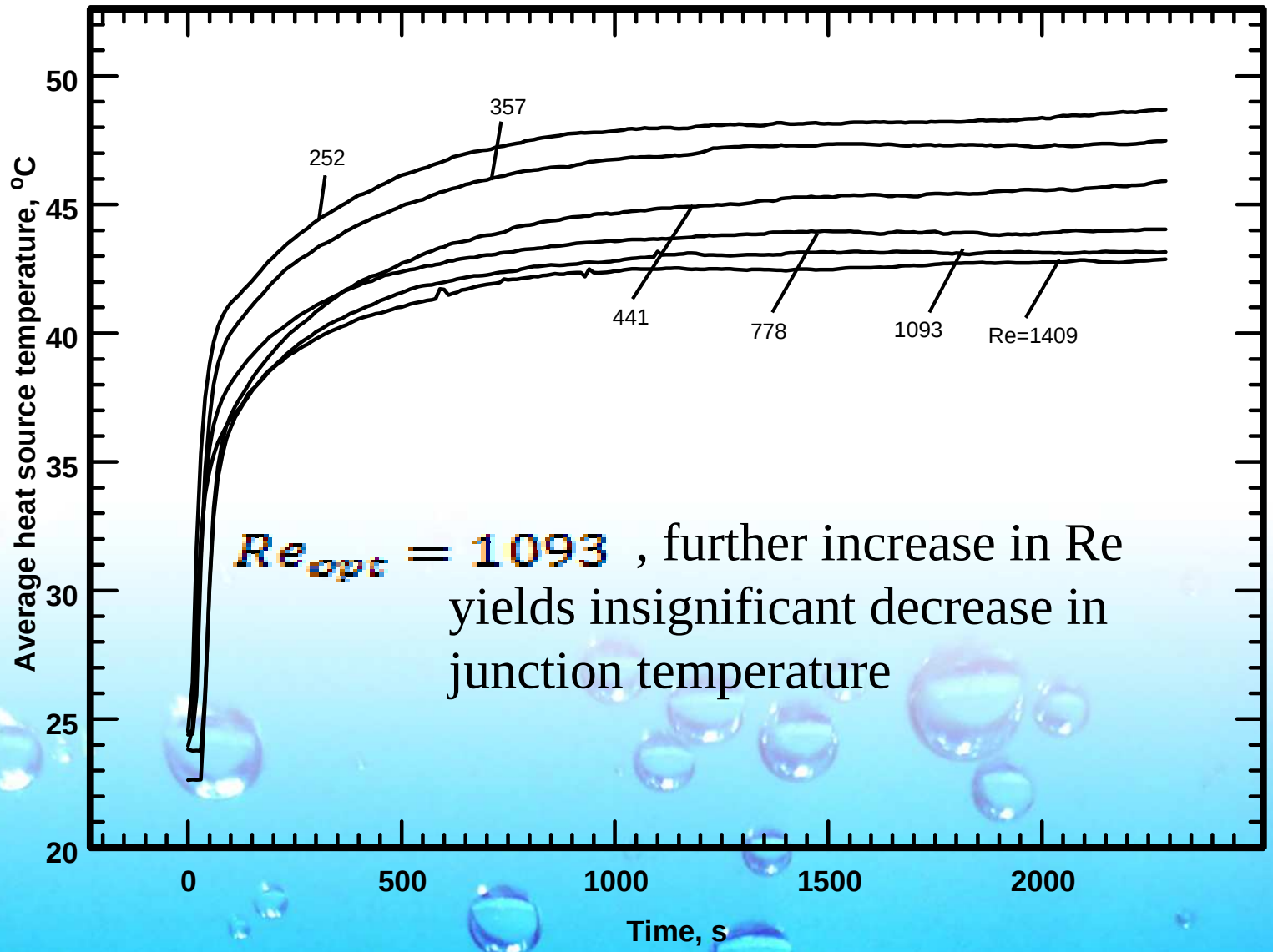

$Re_{opt} = 1093$, further increase in Re yields insignificant decrease in junction temperature

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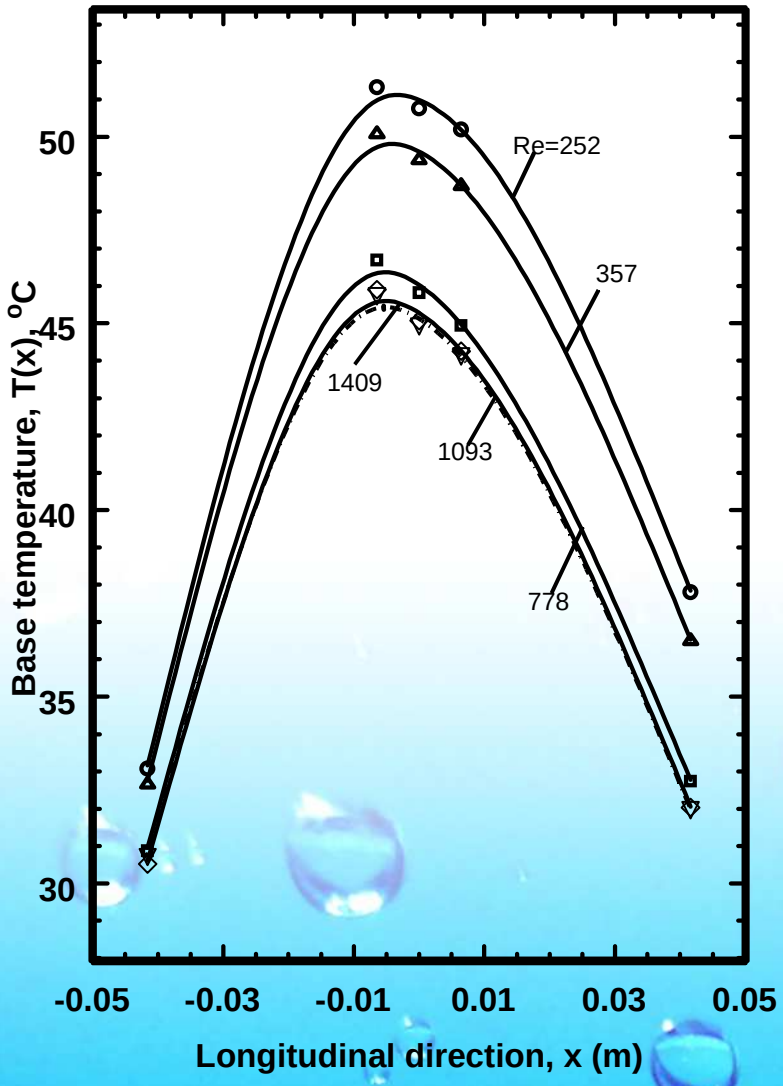

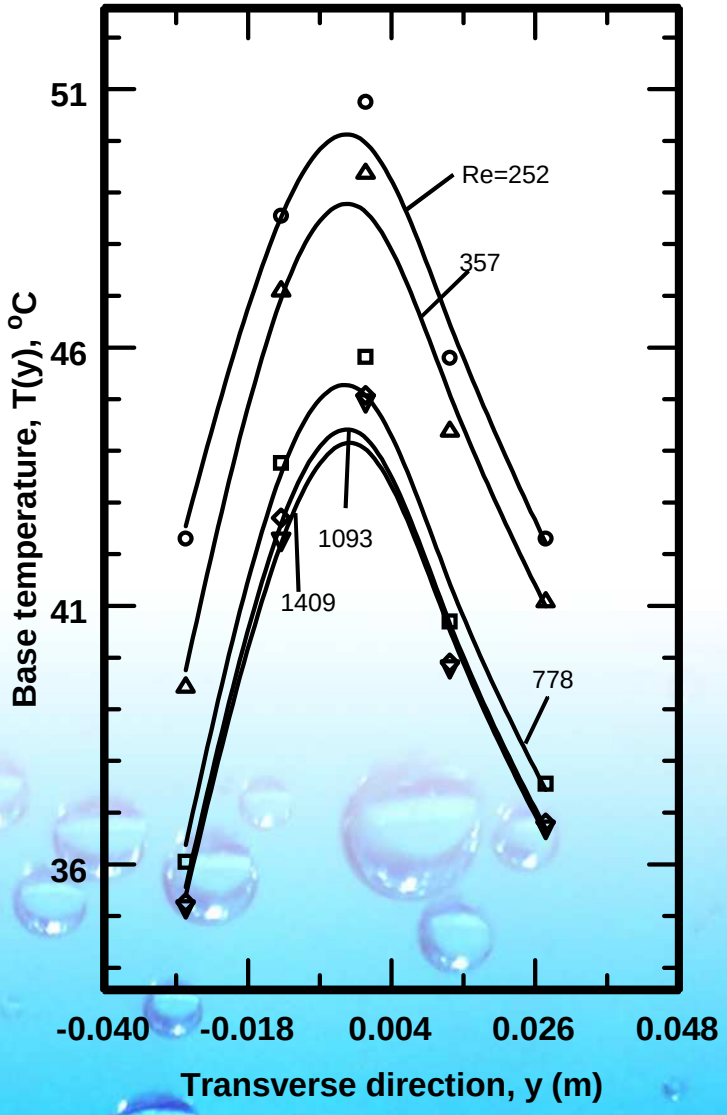

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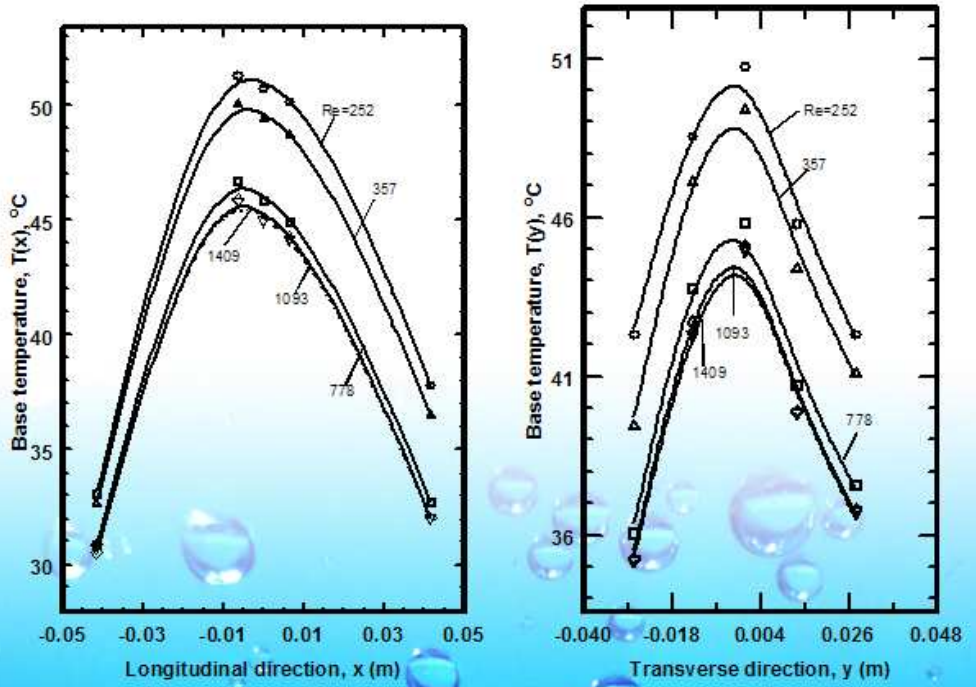
Comparison of temperature profiles



Present study

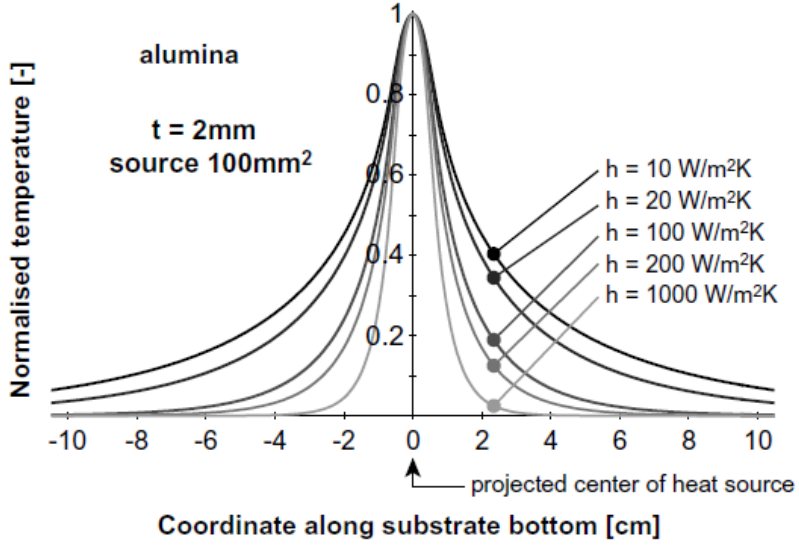


Fig. 8. Exemplary normalised temperature profiles at the bottom of the substrate.

Literature

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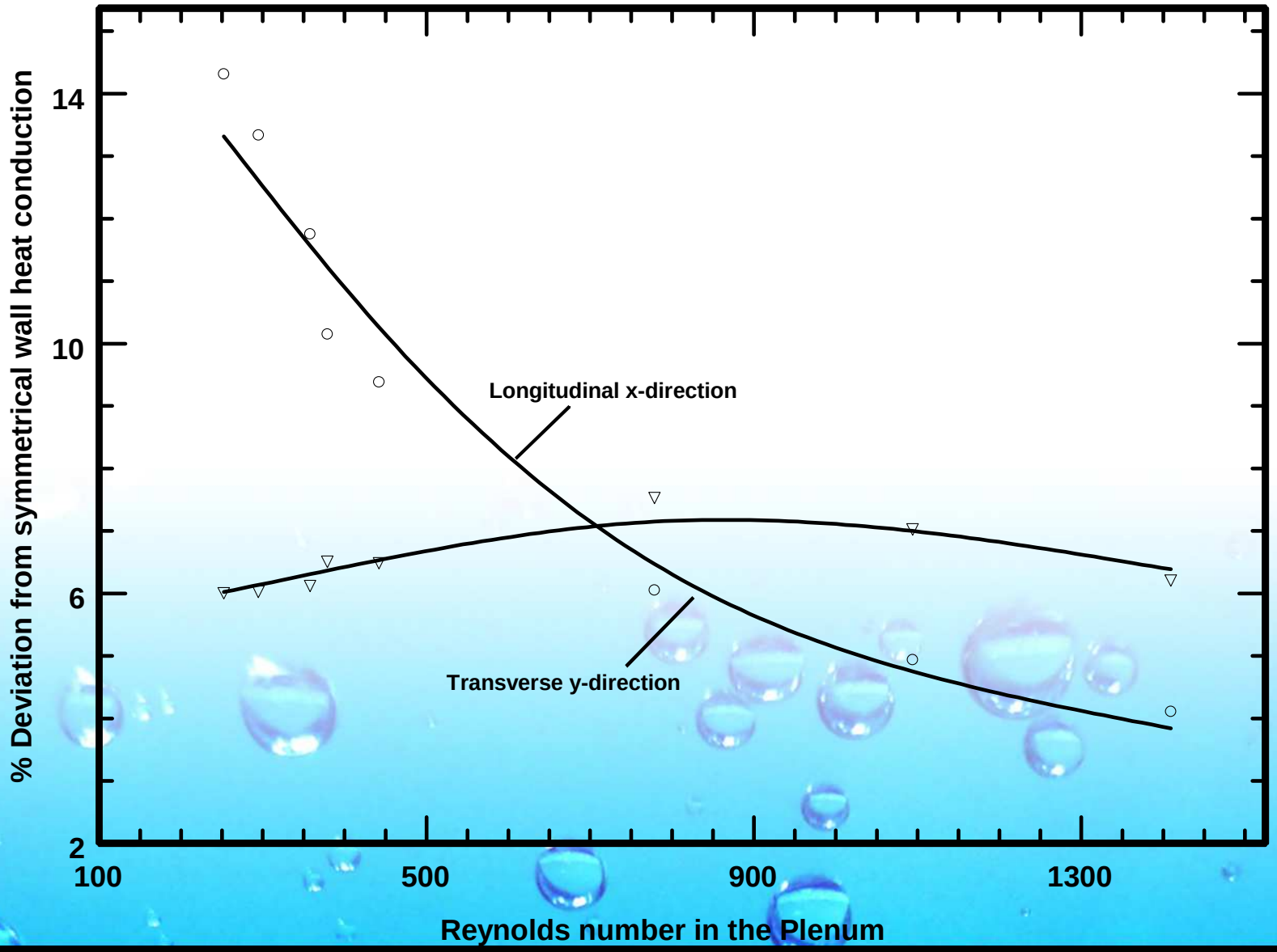

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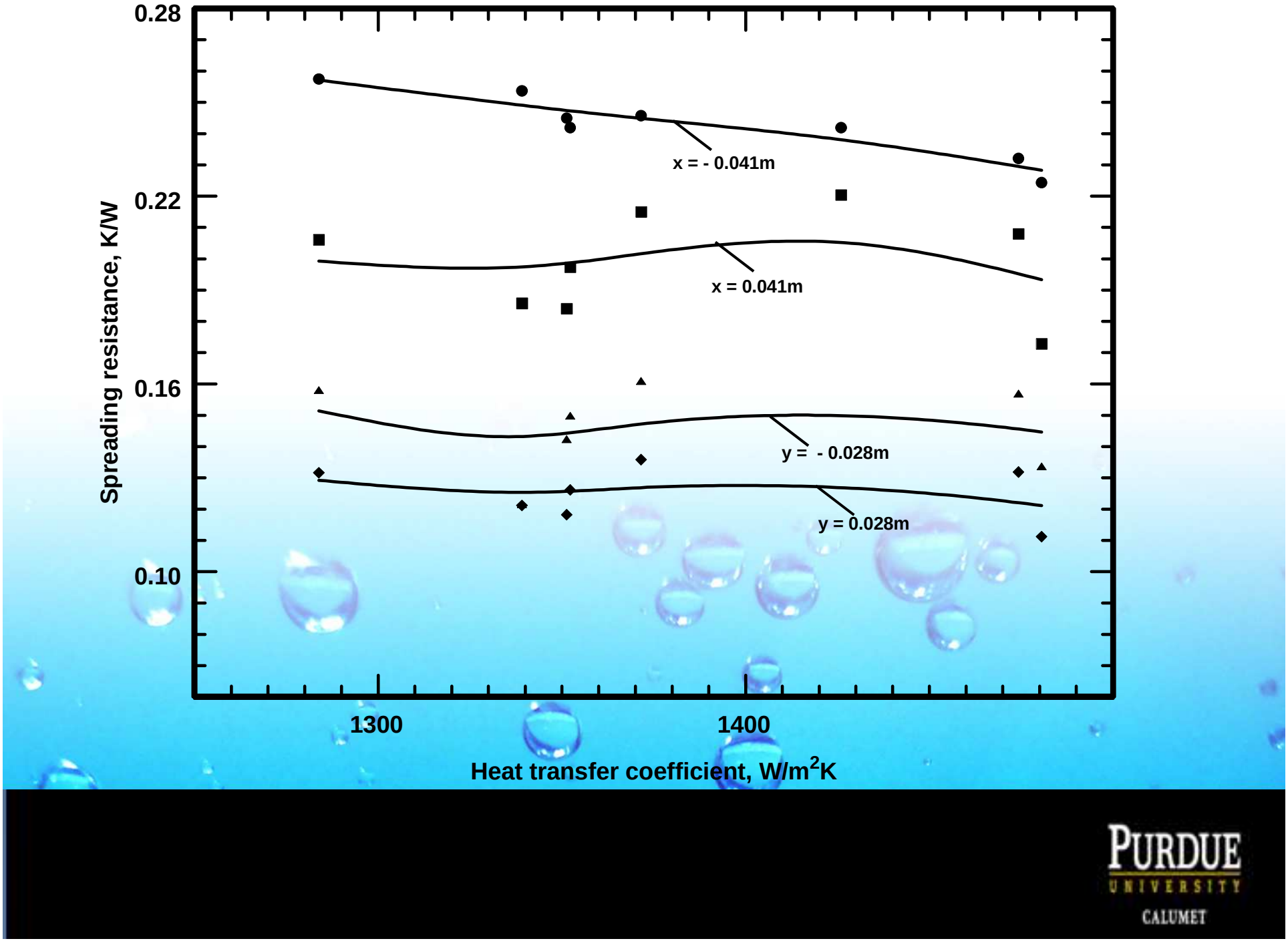

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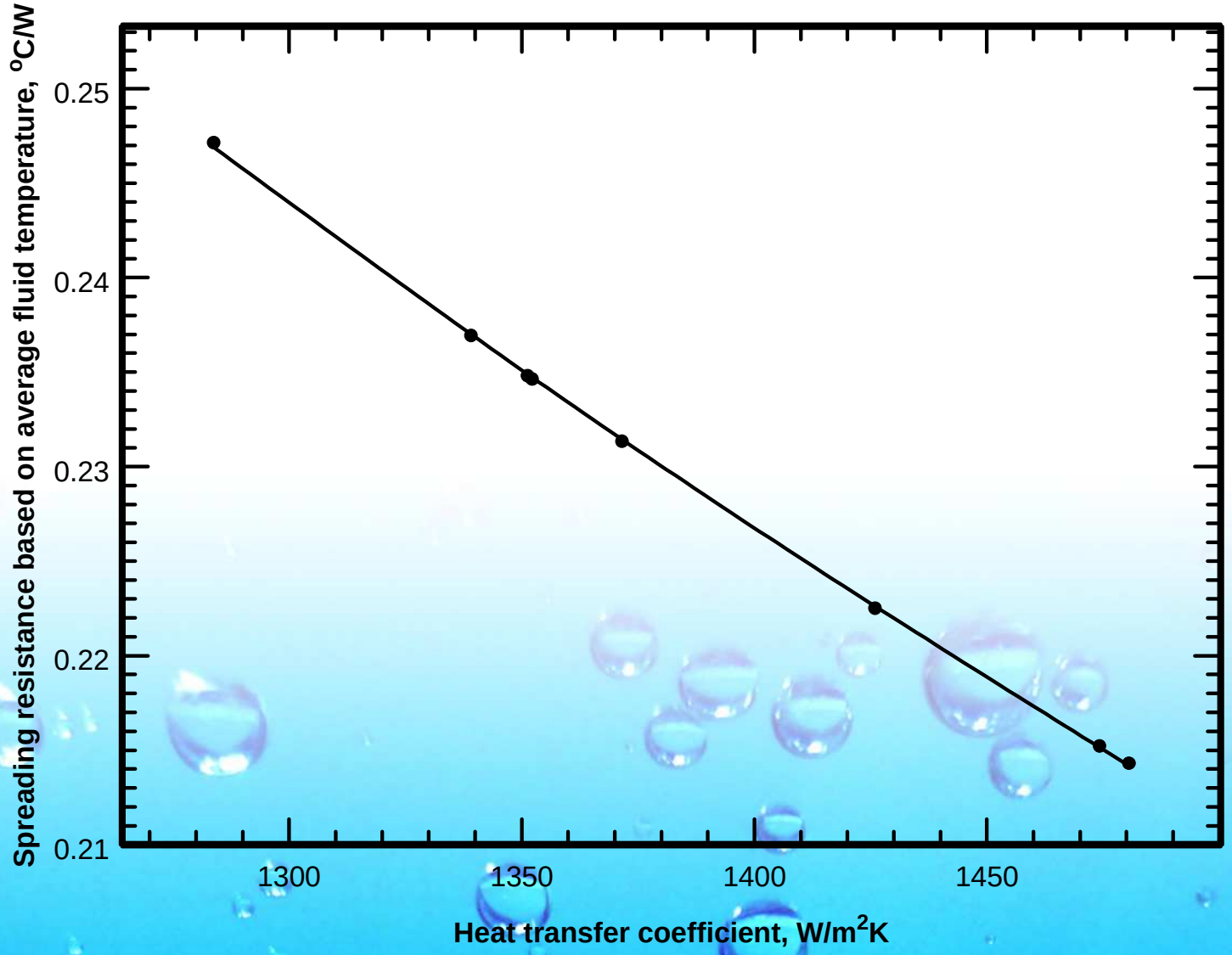

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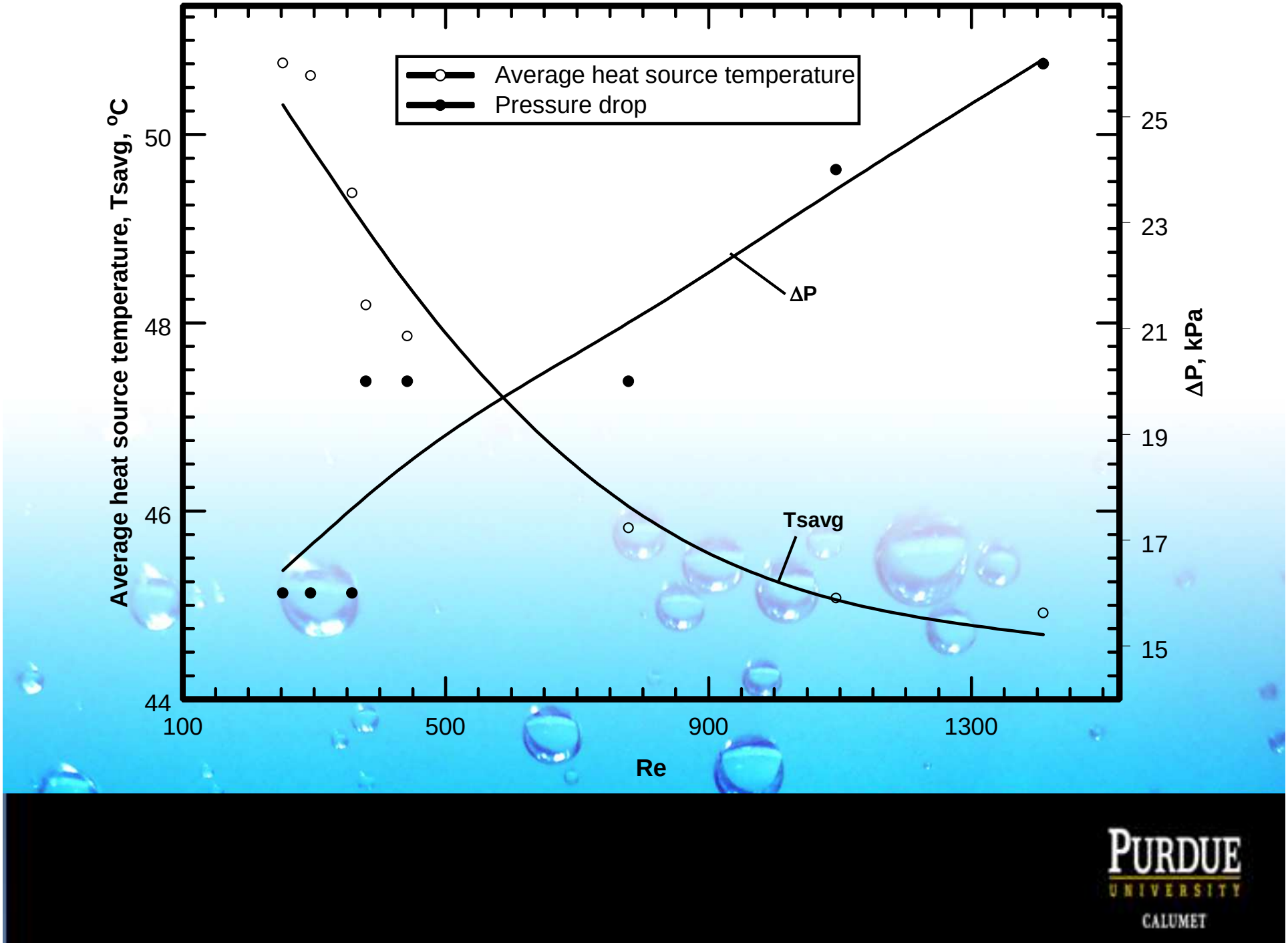

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Conclusion

- It is observed that the heat transfer coefficient is a weak function of thermal spreading resistance
- Longitudinal heat conduction in the leading section is strongly influenced by Reynolds number and decreases with increasing Re
- Longitudinal wall conduction in the trailing section and transverse wall conduction are weak functions of Reynolds number
- The heat source or junction temperature decreases with increasing Re. There exist an Re beyond which further increase in flow rate results in negligible decrease in junction temperature