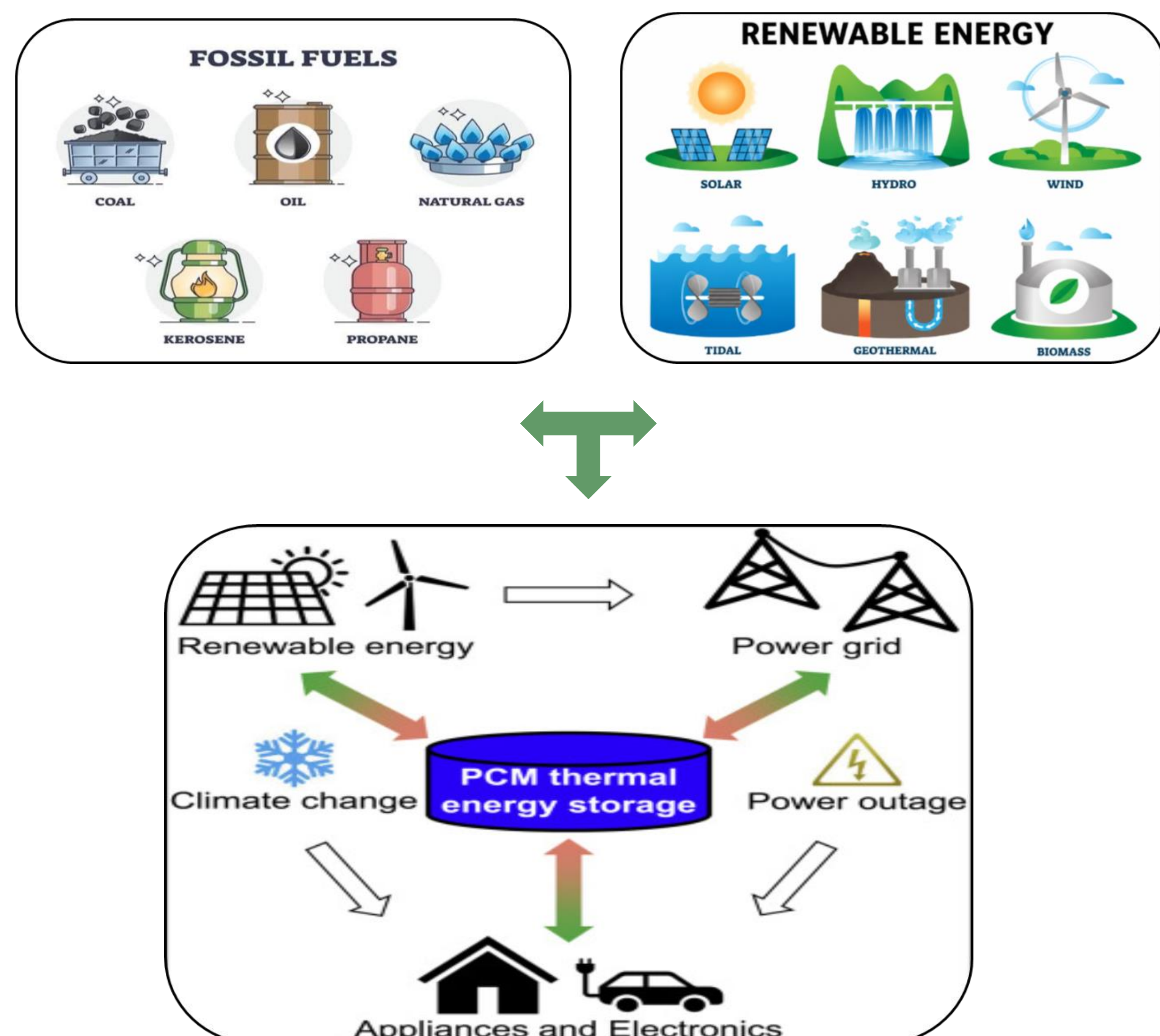


INTRODUCTION

Energy transitions



Aims and objectives

The goal of this work is to evaluate the thermal performance of the PCM, with and without a metal foam system, using Ansys Fluent and to validate the numerical results against experimental data.

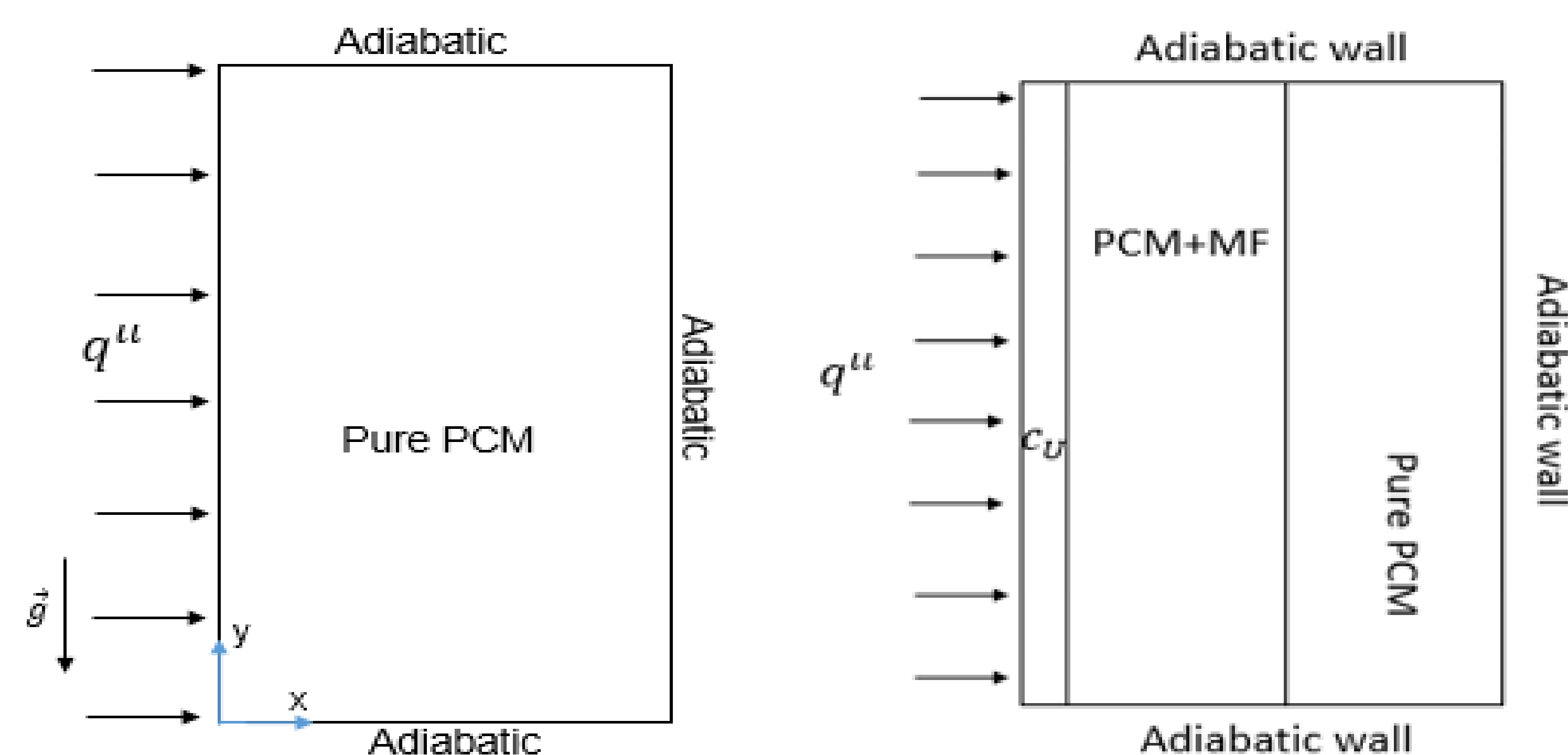
METHODOLOGY

Governing assumptions

The following are some assumptions maintained to achieve physical accuracy (Brent et al., 1988)

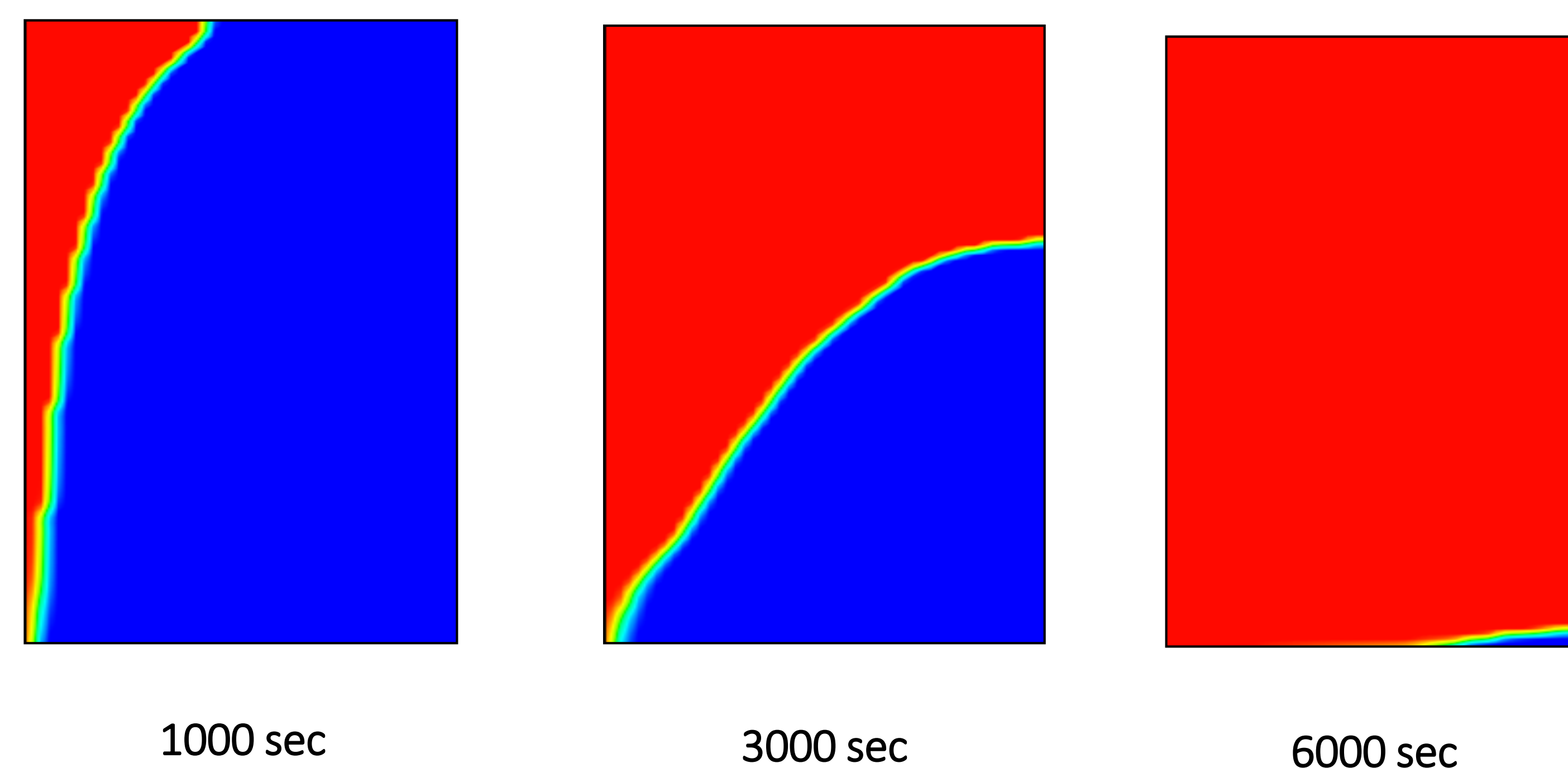
- The PCM is incompressible and Newtonian.
- Thermophysical properties are assumed constant during each simulation interval.
- Heat transfer occurs through conduction and natural convection.
- Metal foam exhibits isotropic porosity and uniform permeability.

Boundary conditions of both the PCM with and without metal foam

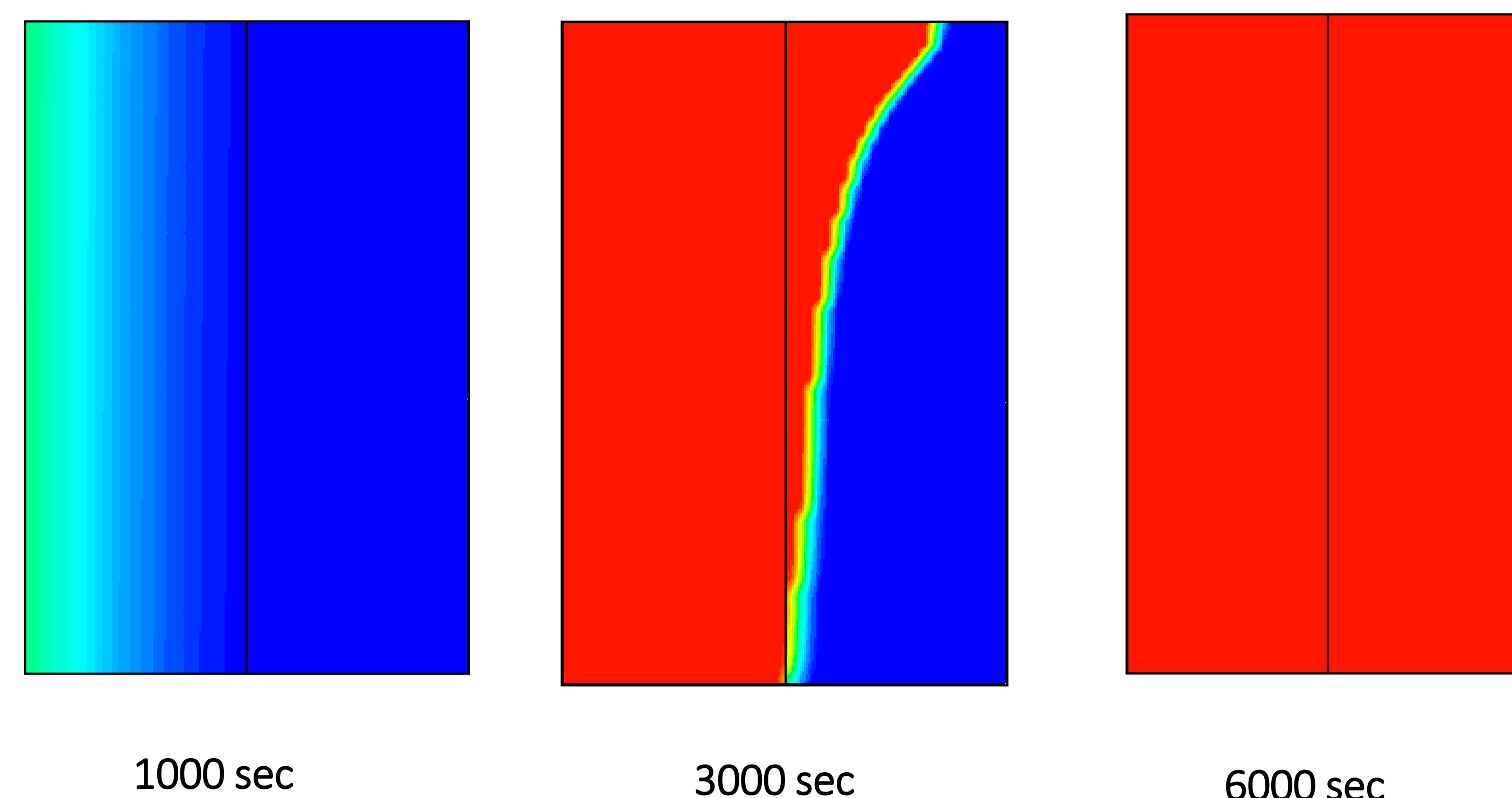


RESULTS

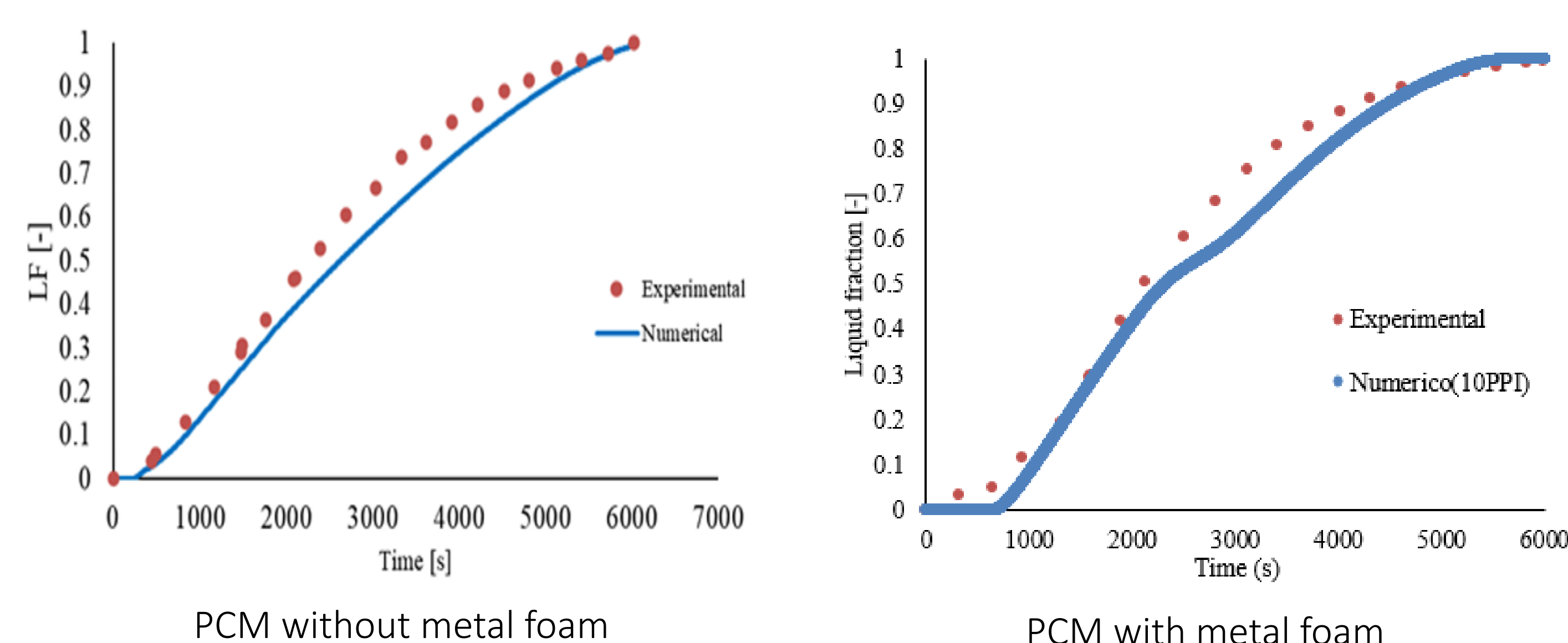
1. PCM without metal foam



2. PCM with metal foam



3. Numerical versus experimental results for melting fraction



CONCLUSIONS

The results show that incorporating metal foam into half of the PCM region enhances heat transfer by increasing the PCM's effective thermal conductivity, accelerating melting compared with PCM without metal foam. The numerical work for both cases, with and without metal foam, was validated against experimental data obtained through non-intrusive optical techniques. The results demonstrate good agreement between numerical and experimental liquid-fraction evolution, confirming the model's reliability for further studies on heat-transfer enhancement strategies.

ACKNOWLEDGMENTS

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