

AI-aided design of high-performance thermal energy storage systems inspired by nature

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Summary

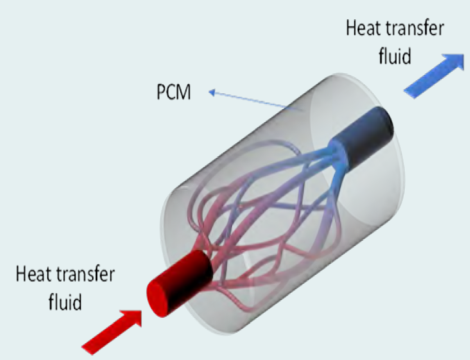
- This research aims to explore using artificial intelligence (AI) and biomimicry to develop high-performance thermal energy storage system (TES) components.
- Novel bio-inspired prototypes will be tested, and their performance simulated using AI to evaluate how biomimicry and data-driven design approaches can jointly create more efficient and sustainable energy storage technologies.

Introduction

- TES systems are important to integrate renewable heat sources by storing thermal energy for later uses. However, designing efficient, reliable and affordable TES is challenging as it requires balancing heat transfer performance, long-term durability of storage materials, and overall system costs.
- AI has potential to evaluate different configurations efficiently and drive the creation of improved designs when applied to TES systems.

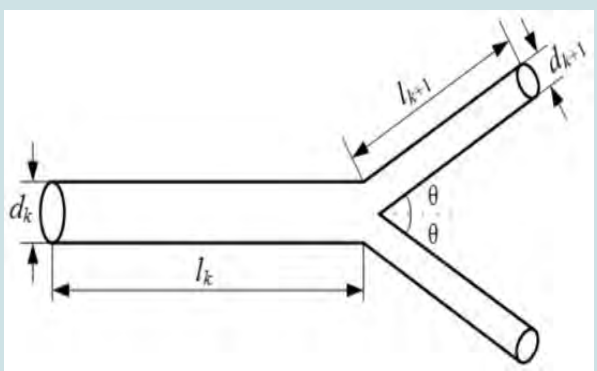
Design features

- Heat transfer fluid enters main tube connected to heat source.
- Tube is divided into smaller tubes following a hierarchical structure.
- Minimum diameter to minimize pressure losses and limit pumping work.
- Fractal distribution of tubes designed to maximize heat transfer area between storage medium and fluid.
- This design features a TES using phase change materials.

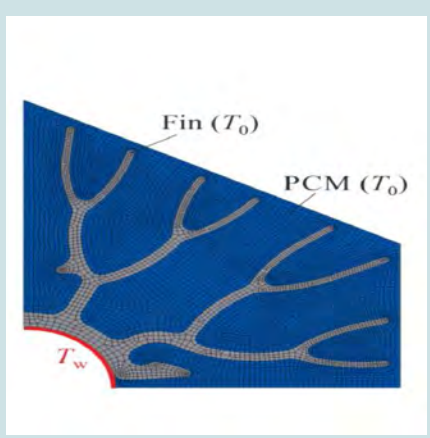
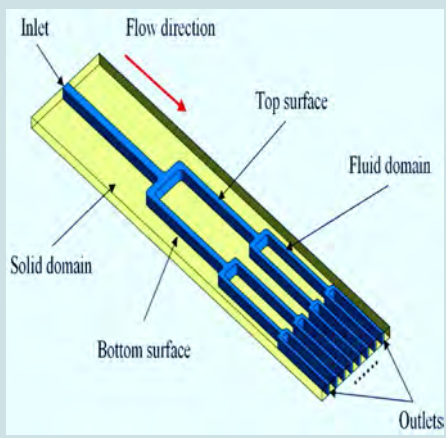


TES tank concept based on biomimetic design

Designs



The geometric parameters of the tree-like branching microchannel.



AGRADECIMIENTOS

This work was partially funded by the Ministerio de Ciencia e Innovación - Agencia Estatal de Investigación (AEI) (PID2021-123511OB-C31 - MCIN/AEI/10.13039/501100011033/FEDER, UE), and Ministerio de Ciencia e Innovación - Agencia Estatal de Investigación (AEI) - NextGeneration EU (TED2021-129462B-I00 - MCIN/AEI/10.13039/501100011033/ NextGenerationEU/PRTR). This work is partially supported by ICREA under the ICREA Academia programme. The authors would like to thank the Departament de Recerca i Universitats of the Catalan Government for the quality accreditation given to their research group (2021 SGR 01615). GREiA is certified agent TECNIO in the category of technology developers from the Government of Catalonia.



El proyecto NitRecerCat (GA 101061189) está cofinanciado por el programa de investigación e innovación Horizonte Europa de la Unión Europea