

Advances in Using Nature Inspired Solutions to Enhance Heat Transfer and Thermal Energy Storage

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Abstract - Living things have been continued to evolve under the pressure of survival and show structures with certain functions. They provide inspirations for humans to cope with challenges that we face today. One of the most impressive progresses in heat transfer and energy utilisations in terms of learning from nature is mimicking plants and animals' surface morphological nature for possible solutions of flow drag reduction and heat transfer enhancement. This paper aims to highlight what we could learn from nature to tackle the challenges in heat transfer and thermal energy storage, and to introduce recent advances. On heat transfer enhancement, the recent work of spray cooling or drops impinging on hot surfaces is reported and the effects of nature inspired morphological surfaces with micro-scaled/nano-scaled hierarchical structures on cooling, thermal management and de-frost/de-icing are discussed. In terms of applying nature inspired solutions to energy storage, the present research using composite phase change materials with hierarchical porous structures for medium-high-temperature energy storage and for solar energy applications are introduced. Such biomimetic structures, inspired by natural plants, could help avoid the leakage of high temperature molten solar salt in the ceramic porous and improve overall performance of heat transfer.