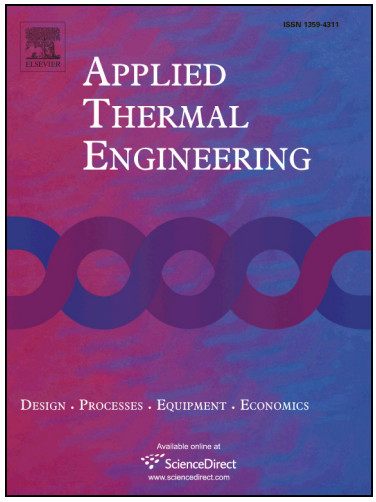

Research Paper

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On the solar receiver thermal enhancement by using the dimple combined with delta winglet vortex generator

Lei Luo[1,2], Fengbo Wen[1], Lei Wang[2], Bengt Sundén[2,*], and Songtao Wang[1]

1 School of Energy Science and Engineering, Harbin Institute of Technology, Harbin, 150001, China

2 Division of Heat Transfer, Department of Energy Sciences, Lund University, Box 118, Lund, SE-22 100, Sweden

Abstract

In this study, effects of dimples and their arrangement on the flow structure, heat transfer and friction factor in a solar receiver heated channel with delta-winglet vortex generators (DWVGs) are numerically studied. The dimples are placed either in an inline or a staggered layout. A smooth channel with pure dimples and a smooth channel with pure DWVGs are studied, in which the smooth channel with DWVGs is considered as baseline. The Reynolds number is ranging from 4,000 to 40,000. Results of the flow structure, heat plate Nu number, friction factor, temperature and turbulent kinetic energy (TKE) are included. The results show that the adoption of dimples significantly impacts the flow structure by interacting with the vortex which is generated by the DWVGs. A small part of the vortex moves downward and impinges on the inline arranged dimpled surface, which is beneficial for the heat transfer enhancement. However, for the staggered arrangement of dimples, the vortex flow is lifted upward before it impinges on the dimple surface. In this case, the inline arrangement dimples provides the best mixing and the highest heat transfer performance. The heat transfer is augmented by 36.23% while the friction factor is increased by 36.29% compared to the

* Corresponding author

E-mail address: bengt.sunden@energy.lth.se