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A review of numerical studies on solar collectors integrated with latent heat storage systems employing fins or nanoparticles

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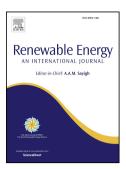
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## ACCEPTED MANUSCRIPT

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#### Abstract

As far as there is concern with the supply and demand of energy, thermal energy storage becomes critical for the efficiency enhancement of all solar thermal energy systems. On the other hand, latent heat storage has been located in the middle of attractions by different applications because of its high energy capacity, specifically without changing in the temperature. The exact analysis of problems that deal with solar thermal collectors is not easy due to their non-linear nature; therefore, numerical solutions should be employed. In the current paper, it is tried to review the most recent numerical studies on solar thermal collectors operated with Phase Change Materials (PCMs) by considering the effects of adding solid nanoparticles and applying different fins as appropriate techniques for energy efficiency improvement. The published articles show that using nanoparticles and fins along with PCMs affect the performance of solar collectors significantly. In addition, challenges and directions for future research in this area are presented and discussed. Regarding to the new generation of solar collectors, which is called as fourth generation, use of heat pipes integrated with nano-PCMs is an excellent idea for future work.

### Keywords

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