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Thermal performance investigation of enhanced receiver tube for concentrated solar collector

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Abstract. This study presents an experimental investigation of conventional and enhanced receiver tube performance for the application of a concentrated parabolic trough collector (CPC). The CPC system is fabricated and tested for the conventional and enhanced receiver tubes. The experiments were performed on both tubes for the change of flow rates. The temperature rise of the tube surface, as well as working fluid, were monitored for varying flow rates. The results were compared and discussed in view of enhanced CPC system performance. The results exhibited that the temperature rise of the working fluid passing through the tube was more in the case of the enhanced tube compared to the conventional receiver tube under the same flow rates.

Keywords: enhanced receiver tube; parabolic trough collector; peripheral temperature variation; surface temperature; temperature rise

1. Introduction

The intensity of solar isolation in Oman is one of the highest in the world and it can fulfill a significant demand if explored successfully. It can be used for heating, electricity generation, process steam generation in the industry, and many other industrial and domestic applications. Solar radiation is a viable and sustainable alternative energy source to fossil fuel power generation, which is causing many environmental and health threats and global warming. The demand for power has raised significantly, which increases the consumption of fossil fuels and contributes to increasing the negative impact on the atmosphere (Epstein *et al.* 2011). Therefore, the application of solar energy is essential to be able to accommodate the continuous need for power generation. The CPC is one of the solar energy harvesting techniques and it mainly consists of a primary reflector, tube receiver, and a working fluid. This paper will focus on enhancing solar energy collection by enhancing the performance of the tube receiver.

Several improvements have been accomplished in the past for the receiver tube, and they can be classified into two general categories, geometric modifications, and material improvements. These enhancements use surface and geometrical modifications as well as modifying the flow channel of

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