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Experimental and numerical study of a cavity and hot mirror receiver of the parabolic trough collector

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The solar parabolic trough collectors (PTC) are the earliest and most widely accepted solar concentration style. It is the most mature technology, has been intensively researched and its cost gradually reduced. In addition, PTC has been put into commercial operations in many countries. The research in this technology is moving towards increasing the efficiency of the system, specifically raising the temperature of the working fluids by minimizing the energy losses. The efficiency of the whole system depends on the most complex part of it, which is the receiver unit. This work aims to design the receiver unit in a way that minimizes the energy losses and raises the temperature of the working fluid. The receiver unit incorporates the application of different optically active layers in tandem with the application of a cavity absorber. The cavity geometry with the hot mirror coating application will enable efficient capturing of incoming concentrated solar radiation via multiple internal reflections. This study entails numerical heat analysis, which is used to simulate the temperature profile of the receiver unit and study the optical properties of different designs. In addition, this idea has been examined in the laboratory and the experimental data will be presented.

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