

Exergy analysis of single-flow solar air collectors with different configurations of absorber plates

In the current study, an experimental analysis of exergy performance for different absorber plates is done. Three types of absorber plates are supplied with different fin arrangements with a variable air mass flow rate. The exergy analysis to evaluate the exergy performance of the solar air heaters uses experimental data for conventional and finned solar air collectors with different arrangements of fins. The main aim of the current study is to compare the exergy performance of the conventional solar air collector with those equipped with fins. The introduction of the fins in different arrangements enhances the absorber surface area, which leads to increased heat transfer. Also, fins induce air turbulence in the flow field, which improves the exergy performance of solar air collectors. It is found that the exergy reduces and exergy efficiency enhances with increasing the airflow rate. The traditional flat absorber plate has undesirable exergy loss and exergy efficiency for all ranges of airflow rates. Thus, the flat plate collector presents the most substantial irreversibility, for which the exergy efficiency is the least. However, the results show that the exergy efficiency of inclined staggered turbulators is higher than that of in-line and staggered turbulators. The optimal value of exergy efficiency is recorded at nearly 77% for the solar air collectors equipped with inclined staggered turbulators compared with other types of configurations.