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ABSTRACT

Enhancements in heat transfer, and consequently the thermohydraulic performance of solar air heaters (SAHs), are necessary to widen and optimize their use in many applications such as solar drying or heating buildings. In this investigation, two techniques were used. A novel solar selective coating combined with broken arc ribs roughness was employed with a SAH and the evaluation of the energetic and exergetic performance was applied under four airflow working conditions compared to a smooth absorber SAH coated with the same coating. The results revealed that the Nusselt number of roughened SAH with the new coating exhibited a notable improvement compared to a smooth absorber SAH and a roughened SAH without a coating. Furthermore, the thermal efficiency increased with the increase in the airflow rate and the maximum rise was 18.8% compared to a smooth SAH. The highest increase in exergy was 51.6% with minimum values of exergy destruction and improvement potentials. In brief, the roughened SAH with 4% CNTs/CuO-black paint under the airflow rate of 0.0244 m^3/s (condition C) exhibited the best energetic and exergetic performance.