International Journal of Hydrogen Energy
Volume 52, Part D, 2 January 2024, Pages 954-972

Solid oxide fuel cell energy system with absorption-ejection refrigeration optimized using a neural network with multiple objectives

Tao Hai [a b c], Farhan A. Alenizi [d], Adil Hussein Mohammed [e], Vishal Goyal [f], Riyam K. Marjan [g], Kamelia Quzwain [h], Ahmed Sayed Mohammed Metwally [i]

Show more

https://doi.org/10.1016/j.ijhydene.2023.07.115

Abstract

The present study focuses on modeling the solid oxide fuel cell power plant combined with an absorption-ejection refrigeration cycle. First, a comparison is made between the absorption chiller refrigeration cycle and the absorption-ejection chiller to connect the superior cycle to the solid oxide fuel cell as an auxiliary cycle. Then, the solid oxide fuel cell cycle, the combustion of the output product, the heat recovery unit combined with the refrigeration cycle, and freshwater production are modeled. Next, the sensitivity analysis is presented in order to study the effect of the design parameters on objective functions, which simplifies the justification of the optimization results based on the genetic algorithm. In order to perform optimization, machine learning methods have been employed to reduce computational time and cost. The optimization of this cycle shows that the exergy efficiency is enhanced up to 68%, whereas the overall cost rate is in within 9.7–10.4 dollars per hour.