Performance Assessment and Parametric Design of a Combined System Consisting of High-Temperature Proton Exchange Membrane Fuel Cell and Absorption Refrigerator

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A theoretical model of a combined system composed of a high-temperature proton exchange membrane fuel cell (HT-PEMFC), a regenerator and an absorption refrigerator (APR) is established, where the APR is used to absorb the waste heat from HT-PEMFC for cooling production. By taking irreversible losses within the proposed system into account, mathematical expressions of the equivalent output power and efficiency for HT-PEMFC, APR and the combined system are derived and the optimum operating regions of system performance parameters are obtained. In addition, the effects of key parameters such as operating temperature, doping level, relative humidity, proton exchange membrane thickness and some composite parameters on the combined system performance are discussed in detail. The obtained results can provide some guidelines for the integration and design of such an actual system.

Keywords: High-temperature proton exchange membrane fuel cell; Absorption Refrigerator; Waste heat recovery; Performance analysis; Parametric design

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