

عنوان مقاله:

Proposal of a novel ammonia brayton cycle integrated with a methane/hydrogen brayton cycle; Thermodynamic and environmental impacts assessments

محل انتشار:

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خلاصه مقاله:

In recent decades, the environmental concerns about utilization of fossil fuels in energy systems have convinced the researchers to chase and employ the carbon-free fuels. Ammonia, regardless of its higher combustion temperature and the significant NO_x emission is considered as a promising type of carbon-free fuels, which improving its chemical properties would introduce it as an excellent heat source of power plants. In present study, the proposal of series of ammonia and methane/hydrogen Brayton cycles connected through the exhaust gas recirculation (EGR) unit was investigated. The EGR unit allowed the overall combined cycle to run with the least value of carbon dioxide and NO_x. Hence, the chemical and thermodynamic analyses were carried out to yield the optimum molar fractions of fuel mixture, which resulted in lower combustion temperature, higher thermal efficiency as well as specific work. Focusing on the equivalence ratio (ϕ) as the key parameter in this study, the results showed that under operating conditions, the overall thermal efficiency improved from ۶۳% to ۷۴%, while the remarkable efficiency improvements in all the three subordinate cycles was observed. In addition, the specific work of overall system showed ۸۰% improvement by ۱۰۰۰ kJ/kg. Furthermore, injection the hydrogen to methane combustion could illuminate the carbon dioxide near to zero. Besides, finding the optimum molar fractions of ammonia-air mixture under the rich region diminished the NO_x emission from about ۱۰۰۰ ppm down to ۱۰ ppm in . This index in lean region was decreased from ۲۵۰۰ ppm to ۱۲۰۰ ppm.

کلمات کلیدی:

Integration, EGR, Equivalence ratio, NO_x Emission

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