

Streszczenie w języku angielskim

Given the escalating demand for energy and the imperative of environmental protection, the quest for novel energy sources and mechanisms for their conversion has become paramount. Moreover, utilizing energy from non-recyclable waste is gaining significance. The study outlined herein provides an experimental investigation into the impact of using diverse types of fuels, including alcohols such as propanol, butanol, and pentanol, and pyrolysis oils derived from the pyrolysis of automobile tires and plastic waste. The study also examines the impact on operational characteristics, thermal efficiency, and emissions of a selected gas microturbine.

The selection of a gas turbine as an energy conversion apparatus is driven by numerous factors. Gas turbines not only possess high energy efficiency but also emit fewer pollutants compared to coal-fired units and internal combustion engines. A significant advantage of gas turbines lies in their ability to bolster other renewable power generation technologies, including solar and wind power. Their rapid startup capabilities and smooth power regulation make gas turbines instrumental in stabilizing the power grid amid renewable power supply fluctuations. Thus, gas turbines become a vital component of a sustainable energy strategy, amalgamating the benefits of innovative technologies with responsible exploitation of natural resources.

This paper details the physical and chemical properties of selected alternative fuels with a particular emphasis on liquid fuels. It includes an analysis of literature reports on the viability of alternative fuels in gas turbines. A comprehensive examination of the state of research on alternative fuels for gas turbine usage underscores the critical role of proper fuel selection, considering its unique characteristics influencing combustion efficiency and emissions. Additionally, an analysis of the current understanding concerning the formation and mitigation of toxic exhaust emissions was conducted.

Experimental tests were conducted on a JETPOL GTM-140 gas turbine, fueled with mixtures of the reference JET A-1 fuel and the aforementioned alcohols and pyrolysis oils derived from the pyrolysis of tires and plastics. An extensive analysis of the experimental results was undertaken, focusing on performance characteristics such as characteristic process temperatures, thrust forces, specific heat consumption values that indicate thermal efficiency, and the levels of harmful substances in the exhaust gas compared to the reference fuel under gas turbine operating conditions.

The research indicated the feasibility of efficient combustion of alternative fuels in a gas turbine without requiring modifications to its design or fuel delivery system. Changes in thrust and specific fuel consumption (relative to static thrust) roughly align with changes in the calorific value of the utilized fuel mixtures. An essential hypothesis concerning the impact of bio-components on combustion quality was confirmed. The incorporation of bio-components to traditional fuels has demonstrated efficacy in combating emissions, thereby highlighting the

potential of bio-components as a green fuel additive to mitigate the environmental impact of gas turbines.

In conclusion, it has been established that a gas turbine can maintain stable operation even when fueled with selected pyrolysis fuels. Although some deterioration in exhaust gas quality was observed, the process of treating waste materials like plastics and automobile tires proves to be a rational approach, particularly considering a significant proportion of waste is unfit for recycling processes.

The conducted research suggests substantial potential for the implementation of a diverse range of energy sources in gas turbine technology. Specifically, this research holds relevance for future work on the utilization of pyrolytic fuels in gas turbines.