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Investigation of a portable standing wave thermoacoustic heat engine

Abstract

Increasing the efficiency and effectiveness of energy systems remains as one of the critical issues today with depleting energy resources and increasing energy demand. Utilization of alternative fuels and utilization of waste heat has also become a major research area. This study reports an investigation on a development of a portable thermoacoustic heat engine that converts energy from a combustion process into acoustic power. The prime mover operates with a temperature gradient imposed on a celcor ceramic stack which then induced pressure oscillations. The system consists of a 42-cm long stainless steel alloy 304 tube with a diameter of 50 mm open at one end. A propane torch is used to model a potential heat source from biomass combustion. No hot heat exchanger is required while copper plates are used as the ambient heat exchanger. At 500°C, thermoacoustic effects and pressure oscillations have been observed with a calculated power of 50 W at the stack. The system which operates at atmospheric pressure with air as the working fluid indicates the potential in utilizing the heat produced from biomass combustion that is widely applied in the rural areas.

Keywords

Acoustic power; Biomass combustion; Energy system; Thermoacoustic heat engine