Grand Technion Energy Program
תוכנית האנרגיה ע"ש גרנד

Technion
Israel Institute of Technology

תכנית האנרגיה ע"ש גרנד מתכבדת להזמינך להרצאה סמינריונית שתינתן ע"י:

אבישי מאיר

התכנית הבין-יחידתית לאנרגיה

בנושא:

Low-temperature energy conversion through a vapor power-cycle in an acoustic resonator

Every year 172 Billion KWh of potential work is lost as exhaust-stream waste heat in the US industrial sector alone, about 60% of it is at temperatures below 230°C. Most of that energy is lost due to high costs of waste heat recovery systems. Current technologies, such as the Organic Rankine Cycle and Kalina Cycle are mostly expensive and require high heat fluxes, making them unsuitable for small scale applications while preventing economical waste heat recovery in homes and other medium-size operations. Finding new solutions for low grade heat recovery may also benefit the renewable energy market by offering new alternatives for solar energy conversion.

The current work aims to develop a new method for energy conversion based on thermoacoustics. Thermoacoustic systems convert heat to mechanical energy by utilizing the pressure and velocity oscillations in a sound wave to create the necessary phasing for a thermodynamic power cycle. As a result, no moving parts are required, making this technology extremely simple and reliable. However, traditional thermoacoustic engines require a high temperature difference, typically higher than 150°C, to initiate self-sustained oscillations, making them unsuitable for low temperature applications. Here, we present experiments performed on a new type of engine that utilizes water as the phase-changing component in a binary gas mixture. This modification is hypothesized to increase the heat flux between the hot and cold heat exchangers, reducing irreversibilities and allowing the engine to operate under a lower temperature gradient.

Our experimental system demonstrated a significant increase in the work output of a thermoacoustic engine after the addition of water. The system was also able to initiate acoustic oscillations under temperature differences as low as 60°C. Operating a thermoacoustic engine under these conditions makes it potentially suitable for a range of low-temperature heat sources currently underutilized such as industrial boilers and rooftop solar collectors.

מנחה: פרופ"מ גיא רמון, הפקולטה להנדסה אזרחית וסביבתית

במסגרת עבודת מחקר לתואר מגיסטר

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