Paper ID: 90804
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22nd IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Interactive Presentations - 22nd IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (IP)

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TEC - THERMAL ENERGY CONVERSION

Abstract

Thermal energy, in the form of waste heat or deliberately generated heat, represents an abundant but under-exploited resource in a variety of industrial, environmental, and domestic processes. Efficient recovery of this energy offers significant benefits, including lower energy costs, a reduced carbon footprint and improved overall efficiency of energy systems.

The aim of this study is to highlight the importance of further research into thermal energy recovery using the Seebeck effect demonstrated by a Peltier module.

This experiment was carried out as part of a project from l'Institut Polytechnique des Sciences Avancées (IPSA) of Toulouse at the Analog Astronaut Training Center (AATC) analog lunar base in Poland, during the seven-day EMMPOLXVII mission.

The aim was to demonstrate the feasibility of powering a 2V LED using thermal energy recovery. Part of this experiment concerned the impact of the number of Peltier modules connected in series on the voltage and the current produced. The sources of heat loss that we identified are: heaters, computer, 3D printer, astrobiologist's experiment, human body, saucepan, kettle, fridge, microwave, furnace. Some cannot be used for practical reasons.

With these different sources, the results showed that the mathematical function which relates the voltage to the number of Peltier modules is linear. The number of Peltier module has no impact on the current.

This initial aim that was to power a 2V LED was achieved having an ambient temperature of 25C and a kettle at 87,5C.

Notably, the highest recorded voltage of 12.37V was obtained using a saucepan containing boiling water and six Peltier modules connected in series. Despite resource constraints and a limited timeframe, the experiment produced promising results, underlining its potential for practical applications and system optimization.

Overall, these findings provide valuable insights into the efficiency of thermal energy conversion methods and lay the foundations for future advances in this field.

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