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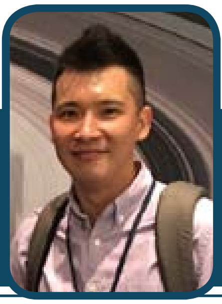

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Power systems for potential spacecraft missions requiring biosensor technologies – Current examples and remaining challenges

The National Aeronautics and Space Administration (NASA) has upcoming spacecraft missions to Mars (i.e., Mars 2020) and is studying future potential missions (e.g., landers, penetrators) to Mars, Europa, Enceladus and Titan that could require unique biosensor systems to search for critical biomarkers in those environments. In-situ sensing capability under extreme environmental conditions is particularly critical for these current and potential NASA space exploration missions. Many missions will need ultra-sensitive sensors capable of reliable operation across a very wide range of temperatures. The applications of the highly sensitive sensor being discussed can include habitat health monitoring for a space station and/or life detection on an Earth-like planet. In order to help fulfill scientific needs, a reliable power system is of prime importance factor for enabling long-lived space missions. Batteries have limited lifetimes, and solar power can be impractical or impossible to use in certain locations or environmental conditions. Radioisotope Thermoelectric Generators (RTG's) have been used on numerous NASA missions when they would enable or enhance their ability to accomplish their goals. The current state-of-the-art RTG, the Curiosity Mars rover's Multi-Mission Radioisotope Thermoelectric Generator (MMRTG), has operated for more than two Martian years (greater than 1800 sols) on the red planet. In order to increase the power output and conversion efficiency of future MMRTG systems and extend the lifetime of future missions, our group focuses on maturing advanced thermoelectric technology for possible use in future RTGs. This presentation will report on our accomplishments on thermoelectric technology for RTG power systems at the Jet Propulsion Laboratory (JPL) and our recent progress for developing a multi-platform in-situ bio-sensing device that is capable of reliable operation across a very wide range of temperatures.

Biography

Ike S Chi is a materials and processing engineer at NASA's Jet Propulsion Laboratory. He is currently the integrated product team lead for Skutterudite Technology Maturation (STM) program and the device development task lead for Advanced Thermoelectric Couples (ATEC) program. He has several years of experience on fabricating advanced thermoelectric (TE) devices and developing novel and highly efficient TE materials for extraterrestrial and waste heat recovery applications. He is also interested in the area of biomedical metals, ceramics, and semiconductors for implants/scaffolds and biosensing using ultra-high surface area materials. He has received his PhD from the Johns Hopkins University in 2014.

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