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Recent and upcoming potential spacecraft missions requiring biosensor technologies: Current examples, what are we looking for and remaining challenges

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The National Aeronautics and Space Administration (NASA) has upcoming spacecraft missions to Mars (i.e., Mars 2020) and future potential missions (e.g., landers, penetrators) in the planning stages 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. JPL/NASA's future planned Europa Clipper multiple flyby mission and a potential Europa lander or the planned Mars 2020 (ESA ExoMars mission) will encounter extreme environmental conditions. This presentation will report on our to-date accomplishments at the Jet Propulsion Laboratory (JPL) on Mars and potential plans in these other extreme deep space environments. Those missions will need ultra-sensitive sensors capable of reliable operation across a very wide range of temperatures. The applications of the highly sensitive sensor developed can include habitat health monitoring for a space station and/or for life detection on an Earth-like planet. In order to help fulfill scientific needs, we have developed a portable and low power *in-situ* biosensor to detect amino acids using an electrochemical spectroscopy technique. We have also enhanced chemical sensitivity of the sensor to parts-per-billion (ppb) range by integrating novel nanostructured electrode materials with improved surface properties. This novel engineered nanostructured micro-device tailored to sense specific analytes (e.g., amino acids) could be integrated with multiple flight-proven sensing platforms for a wide range of missions. This presentation will report on the progress for validating performance of this multi-platform *in-situ* bio-sensing device developed and tested by JPL.

Biography

Ike Chi is a Materials and Processing Engineer at NASA's Jet Propulsion Laboratory. He is the integrated product team (IPT) lead for Skutterudite Technology Maturation (STM) program and the device development task lead for Advanced Thermoelectric Couples (ATEC) program. He is also currently a member of Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) Pyroshock project. He received his PhD from the Johns Hopkins University in 2014. He had several years of experience in fabricating biocompatible ceramics/semiconductors and ultra-high surface area materials. He is also interested in the area of biomedical implants/scaffolds and biosensing

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