PURDUE INNOVATES | Office of Technology Commercialization

Mass Spectrometry to Identify Predictive Failture with Chemical Detection in Microelectronic Systems

Mass spectrometry detects predictive chemical signatures for pre-emptive microelectronic system failure diagnostics.

Researchers at Purdue University have developed a method to identify predictive failure of electronic systems using chemical detection processes. Current methods to analyze failure of electronic equipment are largely reactive and can detect the failure after the damage has occurred. The Purdue researchers' method relies on the fact that microelectronics within a computing system have a unique chemical composition, and thus unique bulk chemical signature produced upon failure. By using mass spectrometry methods to analyze the signature release of an analyte before and after power failure, the method provides fault detection and diagnosis. This method is passive and does not interfere with system functionality. Using this technology, time and cost associated with power, space, and weight applications can be reduced for a variety of electronic equipment.

Technology Validation: The chemical detection method utilized Atmospheric

Pressure Chemical Ionization with Mass Spectrometry to produce a chemical signature of oxalic acid. The evolution of oxalic acid corroborated with dehydration and power failure of the Raspberry Pi, an example of a basic electronic system based on printed circuit boards.

Advantages:

- Pre-emptive

- Non-invasive

- Passive

Applications:

Technology ID

2021-RAI-69314

Category

Aerospace & National Security/Defense, Electronics, & Surveillance Technologies
Materials Science & Nanotechnology/Materials Testing & Characterization Tools
Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

Authors

Lonnie Bentley
Peter Andrew Bermel
Robert Graham Cooks
James Dietz
Hersh Rai
Robert Schrader
John A Springer

Further information

Aaron Taggart
adtaggart@prf.org

View online

- Diagnosing operational failure of electronic equipment

TRL: 3

Intellectual Property:

Provisional-Patent, 2020-12-30, United States

PCT-Patent, 2021-12-22, WO

NATL-Patent, 2023-06-29, United States

Keywords: APCI, Atmospheric Pressure Chemical Ionization, Chemical Detection, Chemistry and Chemical Analysis, Computer Failure, Computer Hardware, Computer Technology, Department of Defense, Failure Detection, Fault Detection, Mass Spectrometry, Predictive Failure, Raspberry Pi