PURDUE INNOVATES | Office of Technology Commercialization

Si Vacuum Transistors and Integrated Circuits

Miniaturized vacuum transistor operating in high heat/radiation for aerospace and high-power electronics.

Researchers at Purdue University have developed a novel Si-based vacuum transistor for integrated circuits with applications in analog, digital, and memory. These types of transistors can be used in a wide array of applications but are exceptionally suited for high-power high-frequency electronics and electronics used in harsh environments. This technology can also be used in compact 3D logic and memory circuits as well as non-volatile logic where the market is currently limited to semiconductors.

Current technologies such as vacuum microwave tubes have poor reliability and are often bulky and expensive. Additionally, there remains an unmet need for solutions in high temperature, high radiation environments. However, Purdue researchers have implemented nanoscale field emitter array (FEA) vacuum transistors made from Si-based materials that are reliable and suitable for environments up to 300 degrees C and have ability to operate under sustained high radiation without exhibiting signs of mechanical failure. The new transistors also ensure data storage in the event of a sudden shut down of power supply, unlike traditional systems.

Advantages:

-Miniaturized for Small Chip

-High Speed Electronics

-Withstands Harsh Environments

-Can Save Data Even in Event of Power Shut Off

Potential Applications:

-Power Amplification

-Electronics

Technology ID
2020-MOHA-68770

Category
Semiconductors/Devices & Components

Authors
Shabnam Ghotbi
Saeed Mohammadi
Noah Opondo
Yanfei Shen

Further information
Matt Halladay
MRHalladay@prf.org

View online

-Automotive

-Aerospace

Technology Validation:

Tested for current density and dopant density performance in high temperatures and high radiation environments in the laboratory.

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2021-03-22, United States

Utility-Gov. Funding, 2022-03-22, United States

CON-Gov. Funding, 2023-09-05, United States

Keywords: silicon vacuum transistor,nanoscale field emitter array,high frequency vacuum electronics,harsh environment electronics,non volatile logic circuits,compact 3D memory logic,high temperature electronics,aerospace vacuum devices,power amplification vacuum ICs,radiation tolerant electronics