

Emerging High Temperature Sensors and Electronics for Future Lunar-Martian Reactors

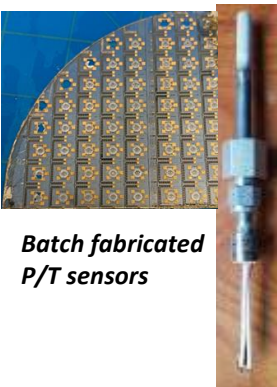


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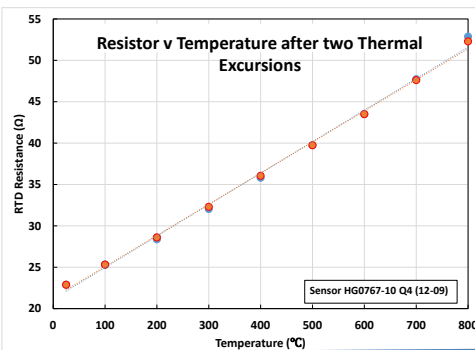
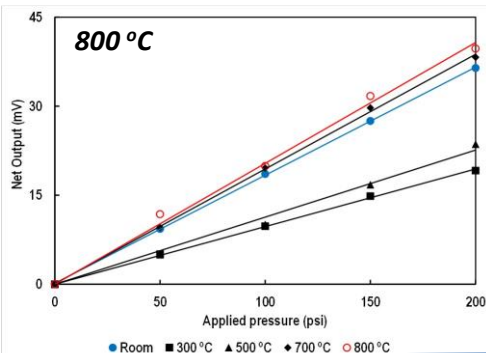
Unique Attributes of Lunar/Martian Fission Surface Power (FSP)

Attributes	Challenges for Instrumentation	Emerging Technologies
Compact	Instrumentation must have small form factor	Integrated multifunctionalities on a single chip
Unmanned	Agile in accident response	Near-core sensing, conditioning, and processing
10 –year Life	Maintenance and replacing faulty parts	Rad-hard, high operating temperature, reliable.

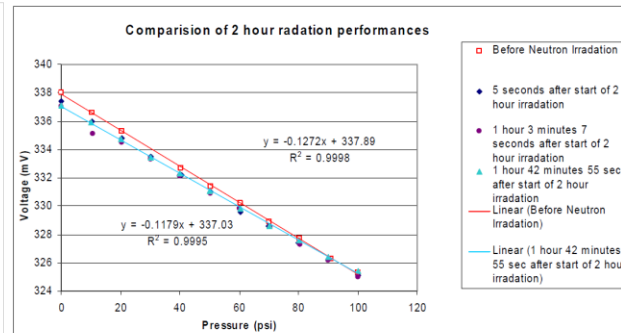
On-Chip Integrated SiC Pressure/Temperature Sensors (near-core sensing)



Batch fabricated
P/T sensors

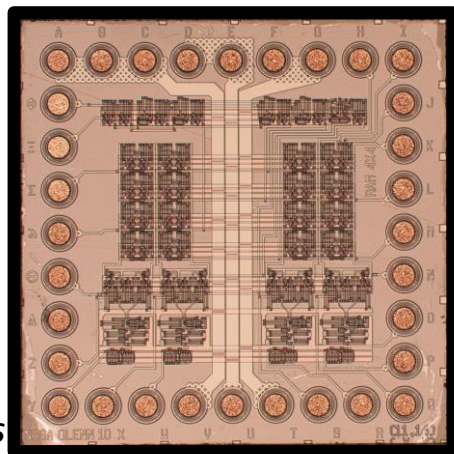


1 MeV equivalent neutron fluence in SiC of $10^{15} \text{ n cm}^{-2}$

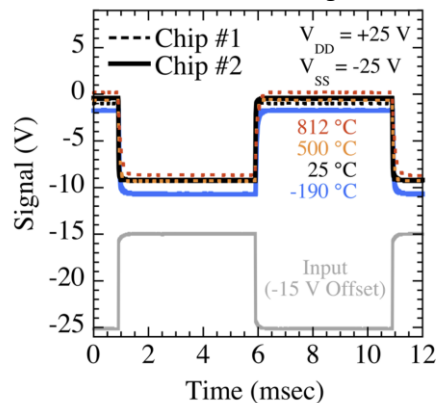


SiC Electronics (near-core signal conditioning)

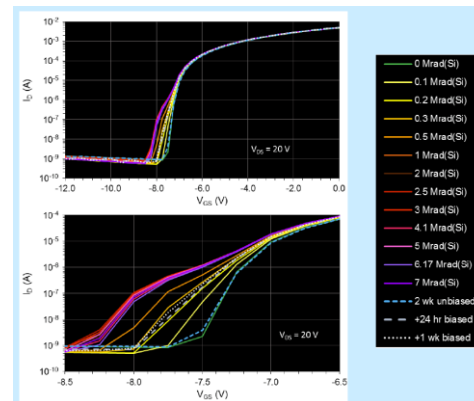
SiC JFET-R RAM Chip



-190 °C to +812 °C SiC JFET-R NOT
Gate Testing



NASA Glenn JFETs tested by NASA Goddard



Total Ionizing Dose Hard
(Gamma > 7 Mrad)
Surpasses Notional
Tolerances



Key Take Away

- **FSP has no luxury of replacing faulty parts!**
- **Instrumentation likely to reside near reactor core.**
- **GRC is developing rad-hard and high temperature instrumentation with reduced form factor**
- **Innovative I&C systems are emerging to address FSP instrumentation challenges.**