INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

An Optoelectronic Neutron Detector

TECHNOLOGY NUMBER: 6284

Technology ID
6284

Category
Hardware
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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OVERVIEW

All-solid-state neutron detector based on Čerenkov radiation

- Provides compact, real-time neutron detection with lower power consumption
- Homeland security, nuclear safety, scientific research

BACKGROUND

The need for efficient neutron detection is critical for protecting against nuclear hazards and threats. Historically, neutron detection has relied on He-3 gas-filled detectors, revered for their high neutron capture cross-section. However, He-3's low natural abundance and dwindling supply have driven the search for solid-state alternatives. Solid and liquid scintillators, doped with isotopes like lithium-6 or boron-10, offer promising pathways due to their favorable absorption properties. Among these, boron-10 loaded borosilicate glass emerges as a strong candidate. Its high density and significant neutron absorption cross-section can potentially match or exceed the efficiency of He-3 detectors, but in a more compact form. As advanced threats and safety requirements continue to escalate, there remains an urgent need for innovative, portable neutron detection technologies.

INNOVATION

Researchers at the University of Michigan have developed a novel neutron detector leveraging the Čerenkov effect in borosilicate glass, combined with modern optoelectronic technology. In this setup, neutrons interact with boron-10 in the glass, producing charged particles that emit Čerenkov radiation as they travel faster than the phase velocity of light in the medium. This radiation is detected by a sensitive p-i-n diode, which creates a charge pulse amplified and processed for real-time detection. The all-solid-state nature of this device offers a compact, scalable, and portable solution, making it suitable for on-the-go applications like wearable neutron dosimeters. The technology promises high sensitivity, excellent gamma discrimination, and ease of integration with existing electronics.

ADDITIONAL INFORMATION

INTELLECTUAL PROPERTY

US10495766B2 "Optoelectronic neutron detector"