Title: GaN as Neutron Detector
EE701: Introduction to MEMS
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Short Abstract:

This project investigates the performance of gallium nitride (GaN)-based semiconductors for neutron detection, addressing critical applications in nuclear safety, medical imaging, and scientific research. GaN, with its wide bandgap (3.4 eV), high radiation hardness, and thermal stability, offers significant advantages over traditional materials like silicon and germanium. The detectors are coated with boron-10 (B-10) or 6LiF, both known for their high neutron capture cross-sections, which emit charged particles upon neutron capture. These particles are then detected by the GaN semiconductor through charge collection. The project involves fabricating GaN detectors with optimized doping levels and device configurations, testing them under controlled neutron sources, and assessing parameters such as detection efficiency, response time, and noise levels. Advanced signal processing techniques are implemented to enhance accuracy. Experimental results indicate that GaN detectors demonstrate high detection efficiency, stable operation in harsh environments, and superior radiation tolerance. The wide bandgap of GaN results in low dark current, reducing noise and improving signal clarity. These findings validate GaN's potential for next-generation neutron detectors, with future work focused on refining device designs and integrating AI-driven signal processing to further improve performance.

References:

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