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Pin Diamond Diode for Alpha Particle Detection[1] HOLLY JOHNSON, ANNA ZANIEWSKI, JASON HOLMES, RICARDO ALARCON, MANPUNEET BENIPAL, FRANZ KOECK, JESSE BROWN, HARSHAD SURDI, ROBERT NEMANICH, Arizona State University — Semiconductors have long been used as radiation detectors for particles such as neutrons, protons, or alpha particles. Historically these detectors have been made of silicon; however, silicon-based detectors are damaged over time by radiation and in some cases must be frequently replaced, require periodic calibration, and are susceptible to thermal noise due to its small bandgap. In this project we demonstrate a PIN diamond-based detector (PIN: p-doped, intrinsic, n-doped). Diamond is a wide bandgap semiconductor with a bandgap of 5.45 eV. PIN diamond has a built-in electric field, allowing it to detect particles without an external bias. The PIN structure has a number of advantages and without an external bias, the signal will have less noise. Compared to silicon, diamond is less susceptible to thermal noise and is more robust to radiation damage, making it advantageous in energetic, high temperature environments.

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