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12.23 GaN Devices and Materials as a Platform for Radiation Hard ICF Diagnostics

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Inertial Confined Fusion (ICF) is undergoing more detailed research to increase neutron yield, and will require high resolution pictures taken at short distances close to the target. Radiation hard diagnostic instruments are needed. For a future 1E18 neutron yield shot, a camera placed at 10 cm away from the target will be subject to 1E15 neutrons/cm² fluence, which can damage Si devices. We have demonstrated that GaN materials and devices have exceptional neutron radiation hardness. We have been systematically testing neutron radiation effects in GaN devices and materials at Los Alamos Neutron Science Center with elevated neutron fluence levels and broader neutron energy spectrum. In 2016-2018 run cycles, we have irradiated GaN materials and devices up to 1E16 neutrons/cm² fluence for fast neutrons. The irradiated samples included GaN substrates, AlN grown on sapphire, AlGa_N UVLED with various Al contents, and GaN HEMT. GaN devices have shown excellent radiation hardness. Activation level permitting, we have characterized electrical performances of GaN device before and after irradiation. No substantial degradation was observed. Our experiments established the GaN devices as a radiation hard platform technology for the breakeven ICF diagnostics.

Primary author(s) : KE-XUN, Sun (University of Nevada Las Vegas)

Co-author(s) : VALLES, Mario (UNLV); VALENCIA, Hector (UNLV); NELSON, Ron (LANSCE)

Presenter(s) : KE-XUN, Sun (University of Nevada Las Vegas); VALLES, Mario (UNLV); VALENCIA, Hector (UNLV); NELSON, Ron (LANSCE)

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