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Charge Carrier Transport Properties in Layered Structure of Hexagonal Boron Nitride (h-BN) and Thermal Neutron Detection Based on h-BN TRI DOAN, SAMUEL GRENADIER, SASHIKHANTH MAJETY, JING LI, JINGYU LIN, HONGXING JIANG, Texas Tech Univ, NANOPHOTONICS CENTER - TEXAS TECH UNIVERSITY TEAM — Hexagonal boron nitride (h-BN) epilayers have been synthesized by MOCVD. It was found that the carrier mobility in h-BN epilayers is strongly dependent on temperature following the power law $\mu \sim T^{-\alpha}$ with $\alpha \approx 3.02$, satisfying the 2D carrier transport limit dominated by the polar optical phonon scattering The deduced maximum energy (wave number) of the optical phonon is $\sim$ 192 meV (or 1546 cm^{-1}). The measured carrier mobility-lifetime ($\mu\tau$) product of h-BN thin films grown on sapphire substrate is 2.83 x 10^{-7} cm^2/V for electrons and holes, which is comparable to that of GaN films grown on sapphire. Thermal neutron detectors based on h-BN epilayers were fabricated and the reaction product pulse-height spectra were measured under thermal neutron irradiation produced by ^{252}Cf source. It was shown that h-BN thin film thermal neutron detectors are capable to resolve specific nuclear reaction products with unprecedentedly high energy resolution.

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