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Optical and optoelectronic properties of hexagonal boron nitride epilayers

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H exagonal boron nitride (hBN) possesses extra ordinary physical properties including high temperature stability, dielectric strength, optical absorption, negative electron affinity, neutron capture cross section, and corrosion resistance. Its energy band gap is comparable to AlN ($E_g \sim 6 \text{ eV}$). Due to its similar in-plane lattice constant to graphene and chemical inertness and resistance to oxidation, hBN is also considered as the ideal template and gate dielectric layer in graphene electronics. The synthesis of wafer-scale hBN epilayers by MOCVD has been demonstrated. It was observed that the band edge emission of hBN is more than two orders of magnitude higher than that of high quality AlN and the emission with the electric field perpendicular to the c-axis is about 1.7 times stronger than the component along the c-axis. The exciton emission in hBN exhibits two-dimensional features. Based on the graphene optical absorption concept, the estimated band-edge absorption coefficient of hBN is about $7x10^5 \text{ cm}^{-1}$, which is 3 times larger than that of AlN. The hBN epilayer based photodetectors exhibit a sharp cut-off wavelength around 230 nm, which coincides with the band-edge PL emission peak. Diode behavior in the p-n structures of p-hBN/n-Al_xGa_{1-x}N (x~0.62) has been demonstrated. These results represent a major step towards the realization of hBN based practical photonic and optoelectronic devices.

Biography

Jingyu Lin is the Linda Whitacre Endowed Chair & Professor of Electrical and Computer Engineering at Texas Tech University. She has made pioneering contributions to the material synthesis, photonic device fabrication, and practical applications of III-nitride semiconductors. She has 340 publications, 10 book chapters and 20 patents with nearly 10000 citations and an h-index of 55. She earned her BS from SUNY College at Oneonta and her PhD from Syracuse University. She relocated to Texas Tech in 2008 from Kansas State University where she was a Professor of Physics and she is a fellow of the American Physical Society.

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