Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Layer-structured hexagonal boron nitride carbon semiconductor alloys for deep UV photonics[1] MD RAKIB UDDIN, Research Assistant, Nanophotonics Center, Texas Tech University, JING LI, Research Professor, Nanophotonics Center, Texas Tech University, JINGYU LIN, HONGXING JIANG, Professor, Electrical and Computer Engineering Department, Texas Tech University
— Hexagonal boron nitride carbon alloys, $h-(BN)_{1-x}(C_2)_x$, are layer-structured semiconductor materials with a tunable bandgap energy from 0 eV (graphite) to 6.5 eV (h-BN). We report on synthesizing (BN)-rich $h-(BN)_{1-x}(C_2)_x$ semiconductor alloys using standard MOCVD growth technique on sapphire substrate. Bandgap energy variation with carbon concentration in the deep UV spectral range has been demonstrated through optical absorption measurements. Experimental results suggest that the critical carbon concentration (x_c) to form the homogenous $h-(BN)_{1-x}(C_2)_x$ alloys is about 3.2% at a growth temperature of 1300 °C. It is expected that homogenous $h-(BN)_{1-x}(C_2)_x$ alloys with higher x can be achieved by increasing the growth temperature. This is a huge advantage over the InGaN alloy system in which higher growth temperatures cannot be utilized to close the miscibility gap. Together with our ability for producing high quality h-BN epilayers, h-(BN)C alloys and quantum wells open up new possibilities for realizing novel 2D optoelectronic devices with tunable physical properties.

[1]National Science Foundation

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Date submitted: 13 Nov 2014 Electronic form version 1.4