Abstract Submitted
for the MAS17 Meeting of
The American Physical Society

Phosphor-free InGaN/AlGaN white-light- emitting diodes on flexible substrates. MOAB RAJAN PHILIP, THANG HA QUOC BUI, MEHRDAD DJAVID, HIEU NGUYEN, New Jersey Inst of Tech — We report high-performance III-nitride nanowire light-emitting diodes (LEDs) on copper (Cu) substrates via the substrate-transfer approach. The nanowire (NW) LEDs were initially grown on silicon-on-insulator (SOI) substrate by molecular beam epitaxy. SOI substrate was then removed by dry and wet-etching methods. In contrast to conventional NW LEDs on Si, the NW LEDs on Cu offer advantages including better efficient thermal management and enhanced light-extraction efficiency (LEE), made feasible due to the use of highly thermally conductive metal substrates and metal reflectors. Moreover, LEDs on Cu have better current−voltage characteristics and stronger electroluminescence, photoluminescence intensities, in comparison to NW LEDs on Si. Finite difference time domain (FDTD) simulations revealed that the LEE of NW LED on Cu is 9 times higher than that of the LED on Si for the same nanowire radius of 60 nm and spacing of 130 nm. Moreover, by tuning the device-active region by varying In/Ga flux ratios, we achieved phosphor-free high-brightness LEDs on Cu with highly stable white-light emission and high color-rendering index of ∼95. III-nitride on metal substrates are thus expected to revolutionize the future era of flexible displays, wearable and general lighting devices.

Moab Rajan Philip
New Jersey Inst of Tech

Date submitted: 28 Sep 2017 Electronic form version 1.4