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Structural and Optical Properties of AlGaN MQWs Grown by MOCVD Using One and Two TMG Sources SHUO WANG, YONG WEI, HONGEN XIE, ALEC FISCHER, FERNANDO PONCE, Arizona State University, MICHAEL MOSELEY, BRENDAN GUNNING, ALAN DOOLITTLE, Georgia Institute of Technology — Multiple quantum wells (MQWs) are grown by metal-organic chemical vapor deposition (MOCVD) at a temperature of 1155 °C. The quantum well (QW) and the quantum barrier (QB) are designed to be $Al_{0.6}Ga_{0.4}N$ and $Al_{0.75}Ga_{0.25}N$, respectively. One sample is grown by the traditional method with one Trimethylgallium (TMG) source. The other is grown with two TMG sources. In the one TMG configuration, the TMG flow rate needs to be changed for QW and QB. During this change, there is no Ga injecting onto the wafer surface, resulting Al-rich dark layers at the interfaces between QWs and QBs seen in the high-angle annular dark-field (HAADF) image. In two TMG configuration, QW and QB are grown by two TMG sources with different flow rates, allowing instantaneous switch between QW and QB. In the HAADF image, the interfaces exhibit no dark layer with better contrast between QW and QB. In the cathodoluminescence (CL) spectra, the two TMG sample shows a higher efficiency than the other by a factor of 7. In the one TMG sample, the Al atoms are mostly gathered at the interfaces, which leads to an ineffective quantum confinement as the width of the barriers is actually smaller than designed. The CL peak of the one TMG sample has shorter wavelength (257 nm) than the two TMG sample (263 nm), because the QW has an actual Ga content lower than 40% and the Al-rich dark layers squeeze up the ground state in QW.

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