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Determination of Heterointerface Band Alignments in nBn Photodetectors Using Off-Axis Electron Holography XIAO-MENG SHEN, ZHAO-YU HE, SHI LIU, YONG-HANG ZHANG, DAVID SMITH, MARTHA MCCARTNEY, Arizona State University — The zero valence-band offset between the barrier and absorber of a nBn photodetector is challenging to achieve practically, which could lead to different electrical characteristics. Long-wave (Sample A) and mid-wave (Sample B) infrared nBn photodetectors with absorbers consisting of InAs/InAsSb SLs and barriers consisting of InAs/AlGaSb(As) SLs, were grown using MBE. Distinctively different electrical characteristics suggested the possibility of different types of band alignments between the barrier and absorber for these two devices, which was attributed to the difference in Ga composition in the barrier layer. Examination of the barrier layers using off-axis electron holography showed the presence of positive charge with an estimated density of 1.810ˆ17/cmˆ3 in Sample B as a result of a type-II band alignment, whereas negligible charge was detected in Sample A, consistent with a type-I band alignment. This staggered type-II alignment of Sample B caused the significant increase in its dark current when strong bias is applied, because electrons from the valence band of the barrier layer can tunnel to the conduction band of the absorber layer.

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