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Improving optical performance of W-structured type-II superlattices by adjusting As_2 and In flux J.C. KIM, J.G. TISCHLER, I. VURGAFTMAN, J.R. MEYER, E.H. AIFER, L.J. WHITMAN, Naval Research Laboratory, C.L. CANEDY, E.M. JACKSON, SFA Inc. — We are investigating "W-structured" type-II superlattices (W-SLs) for use in IR photodiodes. A typical W-SL period consists of a hole quantum well (QW) sandwiched by two electron QWs, which are in turn bounded by barrier layers (*e.g.*, InAs/InGaSb/InAs/AlGaInSb), such that the bulk band-edges form a "W" pattern. The mini-band straddles the GaSb valence and InAs conduction bands, with a direct gap that can be varied from mid- to very long-wave IR. Photoluminescence (PL) has proven to be a sensitive indicator of photodiode performance, and here we present results correlating the PL intensity of W-SL's grown under varying conditions with their structure. X-ray diffraction is used to measure overall strain and periodicity, and cross-sectional STM (XSTM) is used to directly image the atomic-scale structure. We have discovered that roughness at InAs-on-InGaSb interfaces can be controlled by adjusting the As_2:In flux ratio and thereby reducing Sb cross-incorporation in the InAs. The smoother interfaces and reduced strain correlate with stronger PL. By independently adjusting the As_2 and In flux, W-SLs with low strain can be fabricated across a range of wavelengths with PL up to 20% greater than we have previously achieved. We discuss our analysis using XSTM to correlate the PL spectra with the structure of the W-SLs as a function of As_2 and In flux.

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