Supporting Information

Title All-Epitaxial Integration of Long-wavelength Infrared Plasmonic Materials and Detectors for Enhanced Responsivity

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Figure S1

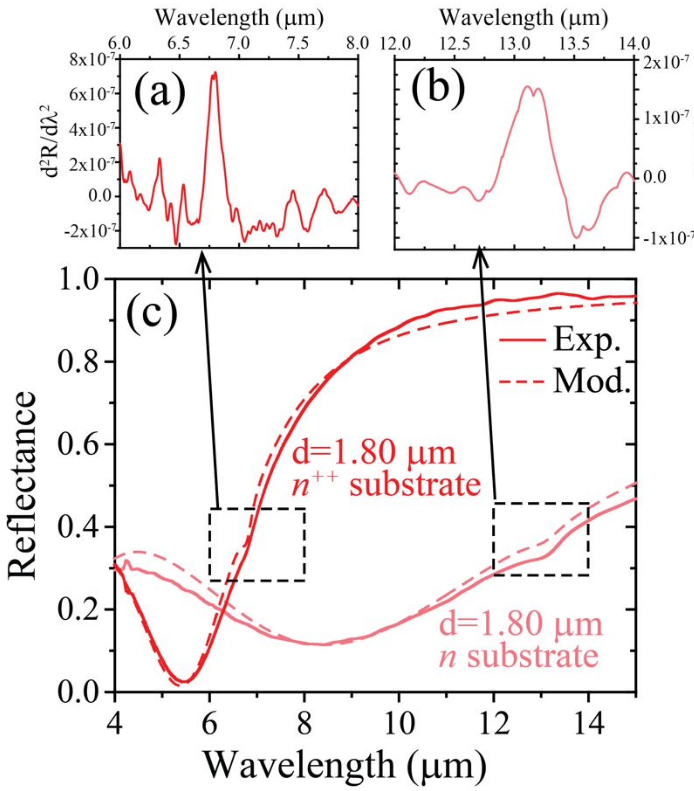

Figure S1. Representative 83 K reflection of the MWIR ground plane of the 1.80 μm thick n^{++} (red) and n (light-red) detector structures (designed for $\lambda = 10$ μm enhancement) and Berreman mode analysis of both detectors. Reflection from just the MWIR groundplane is accomplished by etching off the p-i-n detector structure. Shown in (a) is the second derivative of the experimental reflection from the n^{++} MWIR ground plane around the Berreman mode inflection point, with a clear peak around 6.8 μm. Shown in (b) is the second derivative of the experimental reflection from the n MWIR ground plane around the Berreman mode inflection, with a clear peak around 13.1 μm. Shown in (c) is the experimental reflection from both the n^{++} (red) and n (light-red) MWIR groundplanes and their commensurate Drude-metal fits provided as dotted lines. The plasma wavelength used in the Drude expression is taken from the peak in the second derivative found in (a) and (b) and the spectrum is fit using the scattering rate as the single fitting parameter.

Figure S2

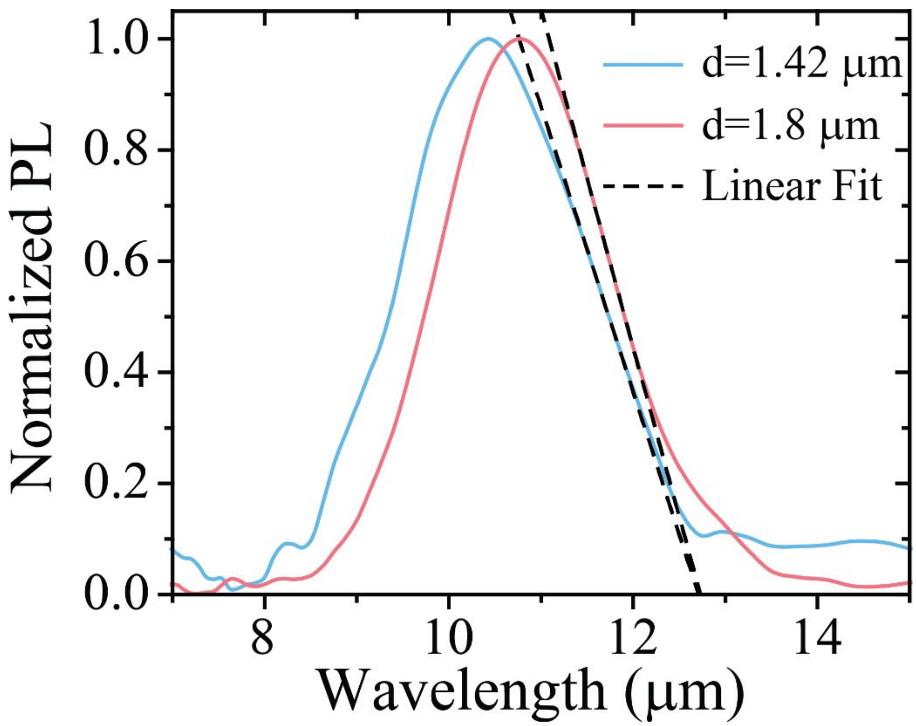

Figure S2. 83 K Photoluminescence of the 1.42 μm thick n (light-blue) detector structure (designed for $\lambda = 8$ μm enhancement) and the 1.80 μm thick and n (light-red) detector structures (designed for $\lambda = 10$ μm enhancement). The extracted detector cut-off wavelength is determined by the x-intercept of a linear fit at the FWHM of the control structure. Note that we use the more lightly doped sample to determine detector cut-off as the strong cavity effects in the n^{++} devices distort the devices' PL spectra. The linear fits to the long wavelength edge of the PL are shown in both plots as dashed lines.

Figure S3

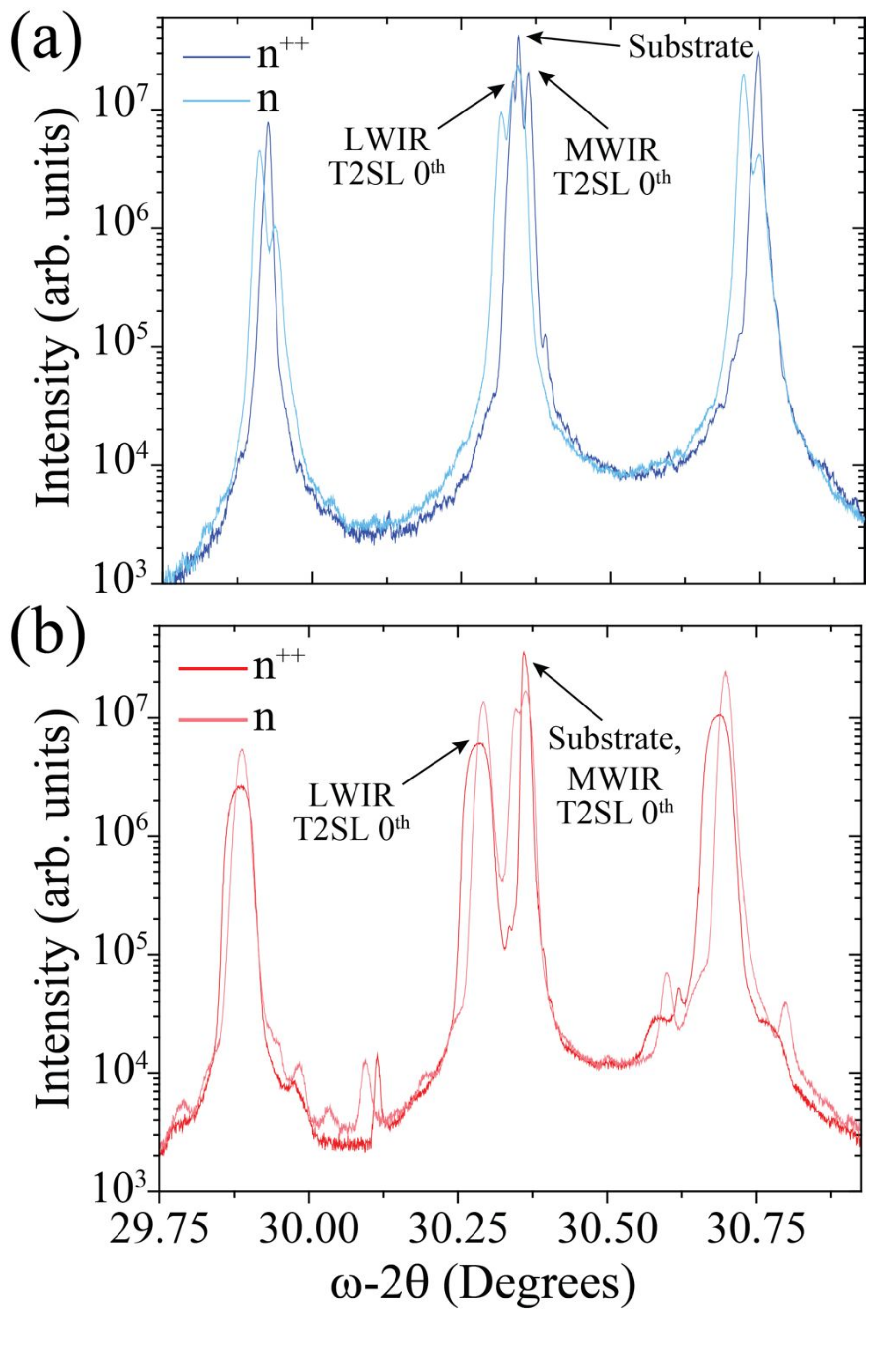

Figure S2. XRD (004) ω-2θ scans of both the n^{++} (red/blue) and n doped (light-red/light-blue). (a) is the $n^{++}$and n devices of the 1.42 µm thick device and (b) the $n^{++}$and n devices of the 1.80µm thick device. For all detectors, the MWIR 0^{th} peak is practically indistinguishable from the substrate peak, suggesting that the MWIR superlatice is extremely well lattice matched in all cases. For the 1.42 µm thick detector show in (a), the LWIR 0^{th} order superlatice peaks sits at a *slightly smaller angle than the substrate, suggesting a miniscule amount of compressive strain, (~250 ppm). For the 1.80 µm thick detector shown in (b), the 0th order superlattice peak sits at a smaller angle than the substrate peak, suggesting some compressive strain (~2000 ppm).*