Progress in Antimonide Unipolar Barrier Infrared Detectors

D. Z. Ting, S. B. Rafol, C. J. Hill, A. Khoshakhlagh, B. J. Pepper,
A. Soibel, A. M. Fisher, S. A. Keo, Y. Maruyama, T. Wenger, S. D. Gunapala
NASA Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California

The unipolar barrier device architecture introduced by the nBn [1] and XBn [2] has led to significantly improved performance in III-V semiconductor infrared detectors. In particular, the combination of the unipolar barrier device architecture and antimonide absorbers, including the InAsSb and the GaInAsSb bulk alloys, the InAs/GaSb type-II superlattice (T2SL), and the InAs/InAsSb type-II strained-layer superlattice (T2SLS), has enabled a new generation of high-performance infrared detectors that can provide continuous cutoff wavelengths coverage in the short-, mid-, and long-wavelength range. Notably, focal plane arrays (FPAs) based on the mid-wavelength Ga-free InAs/InAsSb T2SLS unipolar barrier infrared detector have demonstrated a 40 – 50 K higher operating temperature than the InSb FPA, while retaining the same III-V semiconductor manufacturability and affordability benefits [3]. We will provide an overview of the progress and challenges [4] in the development of antimonide unipolar barrier infrared detectors, as well as some of their applications for NASA infrared spectral imaging needs.

This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

[1] S. Maimon and G. W. Wicks, *Appl. Phys. Lett.* **89**(15), 151109 (2006).

[2] P. C. Klipstein, *Proc. SPIE* **6940**, 6940–2U (2008).

[3] D. Z. Ting, A. Soibel, A. Khoshakhlagh, S. B. Rafol, S. A. Keo, L. Höglund, A. M. Fisher, E. M. Luong, and S. D. Gunapala, *Appl. Phys. Lett.* **113**, 021101 (2018).

[4] D. Z. Ting, A. Khoshakhlagh, A. Soibel, and S. D. Gunapala, *J. Elec Materi* **49**, 6936 (2020).

[+] Author for correspondence: David.Z.Ting@jpl.nasa.gov