

New methods for ultra-sensitive and fast short-wavelength infrared imaging

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Currently, there is no short-wavelength infrared (SWIR) camera that can detect a single photon above cryogenic temperatures. We present the latest results of our electron injection (EI) cameras, which show a clear path toward achieving such a formidable goal. We present a fundamental relation between the capacitance of EI injector and its sensitivity to photons, and show experimental results that strongly support it. We also demonstrate the weak temperature dependency of the EI detectors, which allows operation above cryogenic temperature and with compact thermoelectric coolers.

We also present our latest results for ultra-fast SWIR modulators, used as fast optical shutters, and their applications in time of flight SWIR 3D imaging. Our results show 3D imaging at video rates, with an unprecedented depth resolution due to the low energy consumption in the modulator. Our measurements show our new SWIR modulators consume only ~ 1 fJ/bit, and with a timing accuracy of ~ 4 picoseconds.

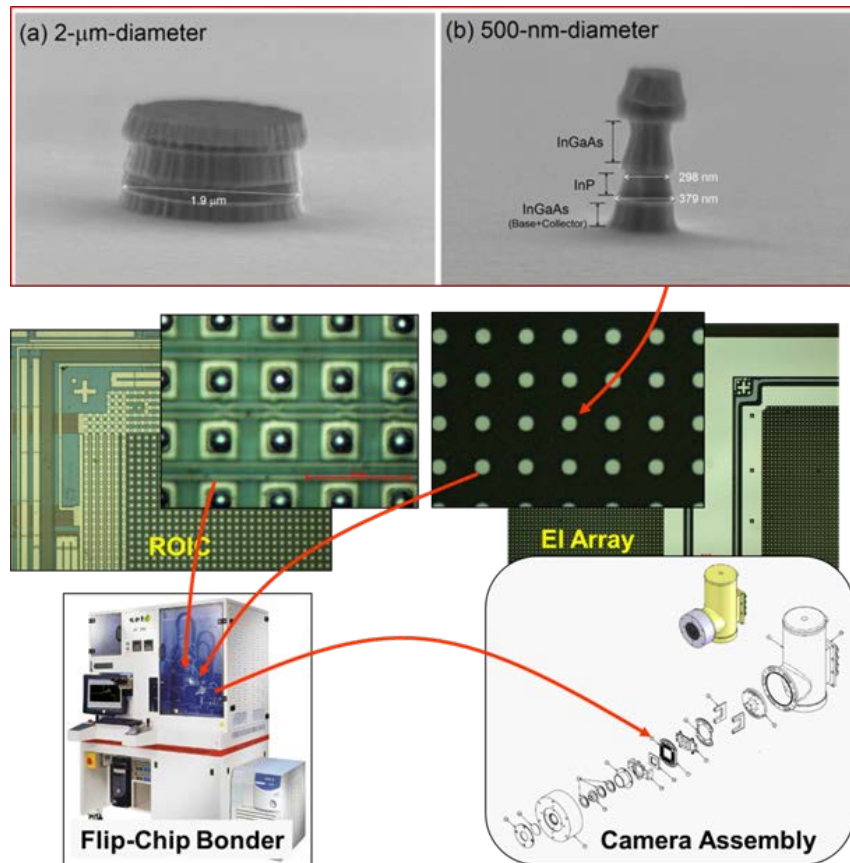


FIG 1. (Top) SEM images of electron injection (EI) infrared detectors, with 2 μm and 500 nm injector diameters. (Bottom) Integration of an EI detector array into an infrared camera.