

Multi-functional devices on Low Cost Substrate

We developed a novel method for three-dimensional heterogeneous integration of devices based on any semiconductor material on a pliant surface with arbitrary surface profile. Arrays of optical detectors in the form of vertically oriented micro/nano-pillars with diverse bandgaps and physical properties are fabricated via synthetic bottom-up or transformative top-down approaches on a single crystal surface and then transferred to a different target surface using a polymer assisted shear-fracturing process. The original wafers are used repeatedly for generating more devices and are never consumed. Ohmic contacts with low contact resistance are formed for individual electrical addressing of each layer of sensors using metals and/or conducting polymer such as PANi and PEDOT:PSS. The method offers an opportunity for device fabrication with low fill factor contributing to lower dark current, reduced parasitic capacitance and higher efficiency of light absorption particularly for applications such as multi-spectral imaging, sensing, energy conversion, and photovoltaics.

