EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

Author: Prof.Dr. Gabby Sarusi
Ben-Gurion University of the Negev, Israel

CONCEPT OF JOINT SHORT WAVELENGTH INFRARED AND VISIBLE CAMERA FOR EARTH OBSERVATION IN NANO-SATELLITES

Abstract

Volume and weight are the main constrain when designing nano-satellites. Earth observations require multiple spectral bands such as visible and short wavelength infrared (SWIR: 1200 to 1800 nonometer). Mirror optics can cover all spectral band and thus can be common. On the other hand, the camera that includes the sensor, electronics and mechanical frames should be duplicated for each spectral band since the sensors are not identical. Here we propose to use the same detector linear array (such as Si based linear array) for both bands the visible and the SWIR using the same electronics that can be switched between simmilar Si based sensors. The response to different spectral bands will be done by attaching a thin upconversion layer developed under a grant of the Israeli national initiative (INNI) committee that convert SWIR image to visible image thus detected by the Si linear array when is intimately attached to. This integrated up-conversion layer unlike other upconversion devices (1) will emit the visible image from the opposite side. This layer composed of several nanometers thick sublayers. The first sublayer is the detection layer that absorbs the SWIR photons. This layer is made of few hundred nano-meter thick PbSe nano-columns or nano-spheres having high absorption coefficient due to the large oscillator strength imposed by its quantum size effect that also blue shifted its absorption peak wavelength Mid IR of bulk material to SWIR range. The photo generated carriers (holes) generated in the nano-sphere or in the nano-columns are drifted by the external applied electric field toward an OLED structure spin-coated on the PbSe nano-structure layer. The thickness of the photo sensitive layer is around 300-400nm which allows almost collision free path from the infrared absorption point trough the electron-hole recombination location in the OLED. This direct flow of the carried in absorption layer allows blur free image emitted from the OLED structures. In this layer the charge carrier are recombining with electrons injected via a transparent cathode, giving rise to visible photon emission through this cathode. Any visible photon emitted toward the absorption layer is reflected back by the pixilated gold layer toward the transparent cathode. The cathode side is then attached to the Si detectors. Due to the tuneability of the absorption wavelength controlled by size of the nanostructures, many bands can be detected using same camera electronic and similar sensor linear array.