Abstract: We report photoresponse observations in epitaxial graphene (EG) devices with asymmetric metals (Au, Al) contacted in planar Au/EG/Al device format. The transient photocurrent measurements on the zero-bias device show photocurrent maxima at the Au/EG contact and minima at the EG/Al contact. This observed significant difference between the two types of junctions is responsible for the overall efficient device photoresponse. We have also found that the number of EG layers influences the photocurrent magnitude and response time regardless of incident photon energy or intensity. An external photoresponsivity (or efficiency) of ~ 31.3 mA W$^{-1}$ is achieved with a biased Au/EG/Al photodetector at excitation wavelength of 632.8 nm.

**Materials & Characterizations**

- Epitaxial graphene (EG) on semi-insulating 4H-SiC substrates
- Two layer EG (FWHM ~ 60 cm$^{-1}$) and Four layer EG (FWHM ~ 75 cm$^{-1}$)

**Results and discussion**

**Device fabrication & Photoconductive characteristics**

- Schematic view of zero-bias Au/EG/Al device connected to a cathode ray oscilloscope (CRO).
- Optical micrograph of the EG device contacted with Au (yellow) and Al (white) metals.

**Conclusion**

In summary, we have demonstrated the photoresponse in epitaxial graphene devices with asymmetric Au and Al metallization scheme. The zero-bias device photoresponse directly observed in digital oscilloscope shows significant differences in photocurrent magnitudes near the Au/EG and EG/Al contacts, resulting in significantly higher device photoresponse efficiencies. Specifically, we found that the number of layers in EG further influences the photocurrent magnitude and response time regardless of incident photon energy or intensity. The maximum external photoresponsivity ~ 31.3 mA W$^{-1}$ at a bias voltage ~ 0.7 V under illumination with 632.8 nm wavelength was estimated. The finding shows that graphene devices with asymmetric metal contacts can be used as photodetectors that is fast, efficient and with low power consumption.

**References**