Highlight Narrative

The first GaS nanosheet-based photodetectors are demonstrated on both mechanically rigid and flexible substrates. Highly-crystalline, exfoliated GaS nanosheets are promising for optoelectronics due to strong absorption in the UV-visible wavelength region. Photocurrent measurements of GaS nanosheet photodetectors made on SiO$_2$/Si substrates and flexible polyethylene terephthalate (PET) substrates exhibit a photo-responsivity at 254nm up to 4.2 AW$^{-1}$ and 19.2 AW$^{-1}$, respectively, which exceeds that of graphene, MoS$_2$, or other 2D materials-based devices. Additionally, the linear dynamic range of the devices on SiO$_2$/Si and PET substrates are 97.7dB and 78.73 dB, respectively. Both surpass that of currently-exploited InGaAs photodetectors (66 dB). Theoretical modeling of the electronic structures indicates that the reduction of the effective mass at the valence band maximum (VBM) with decreasing sheet thickness enhances the carrier mobility of the GaS nanosheets, contributing to the high photocurrents. Double-peak VBMs are theoretically predicted for ultrathin GaS nanosheets (thickness less than 5 monolayers), which is found to promote photon absorption. These theoretical and experimental results show that GaS nanosheets are promising materials for high performance photodetectors on both conventional silicon and flexible substrates.

Reference:

“Highly Responsive Ultrathin GaS Nanosheet Photodetectors on Rigid and Flexible Substrates”
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