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GeSe/IGZO van der waals Diode

Metal-oxide semiconductor are conventional and long-established to fabricate metal-oxide semiconductors field-effect transistors (MOSFETs), solar cells, light-emitting diode (LED) and photo diodes and extensively used in the display industry [1,2]. IGZO has many advantages, such as low off state current density, low subthreshold swing (S.S.) and an ability for room temperature manufacturing. Despite that, the large optical bandgap of IGZO (3.2 eV) has limit its application to the light with greater wavelengths (>420 nm) [3]. To enhance the sensing characteristics of IGZO, the IGZO is coupled with different p-type materials to make p-n junction.

In this research, n-IGZO/p-GeSe van der waals hetro-junctions were fabricated on a Si/SiO2 (300nm) substrate to study the electrical properties. GeSe exhibits a markedly anisotropic electronic transport, with maximum conductance along the armchair direction. GeSe has an indirect bandgap of 1.08 eV in the bulk [4] and a direct bandgap of ~ 1.7 eV in monolayers [5,6]. It has been reported that GeSe has high photoresponsivity along the a3 (perpendicular to the plane) direction [7,8]

The IGZO (In−Ga−Zn = 1:1:1) was fabricated by RF magnetron sputtering. The IGZO was sputtered on SiO2/Si substrates with 3% oxygen at 0.5 Pa in ambient argon and then annealed at 400 °C for 1 h to improve the crystal structure and stability of the IGZO film. After deposition and annealing, few layers of GeSe was transferred over the n-IGZO by dry transfer method. Finally, Cr/Au contacts (5nm/70nm) were deposited over p-GeSe.

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