

Supplementary Information

Synthesis of Mid-Infrared SnSe Nanowires and their Optoelectronic Properties

Faheem K. Butt^{a‡}, Misbah Mirza^{b‡}, Chuanbao Cao^{a*}, Faryal Idrees^a, Muhammad Tahir^a, Muhammad Safdar^b, Zulfiqar Ali^a, M. Tanvir^a, Imran Aslam^a

Experimental

In a typical process, firstly equal amount of Tin powders (99.99%, Alfa Aesar) and Selenium powders (99.99%, Sigma- Aldrich) were sealed into an evacuated fused quartz tube and melted by heating overnight at 700°C. The melt was then homogenized by continuous agitation on removal from the furnace. On removal from the tube the powder was crushed and grounded to an approximately 200-mesh particle size using an agate mortar. 0.2 g prepared SnSe powder was put into a crucible which was loaded into the centre of a conventional CVD furnace. 0.1g Se was kept separately at a distance of 8cm upstream for obtaining stoichiometric ratio of SnSe nanowires. A 10 nm gold pre-coated silicon substrate was placed at appropriate distance from the centre of furnace tube. A mixture of carrier gases, pure Ar mixed with 50% H₂. The gas flow was adjusted at a flow rate of 15 SCCM and pressure of 100–250 Torr. The temperature of central zone of furnace was 950°C. The reaction was maintained for 60 minutes. The furnace was flushed with gases to remove possible oxygen content for 15 minutes.

The prepared product was characterized by X-ray diffraction (XRD) (Philips X'Pert Pro MPD with standard Cu-K α radiation source, $\lambda=0.15418\text{nm}$), field emission scanning electron microscopy (FESEM), energy dispersive X-ray spectroscopy (EDS), Transmission electron microscopy (TEM, JEOL-JEM-2100F), high resolution transmission electron microscopy (HRTEM) and selected area electron diffraction (SAED). Optical properties were studied using UV–vis–NIR UV-4100 spectrophotometer. Electrical transport properties were measured in a two probe configuration using Keithley-4200 semiconductor characterization system (SCS).). A 500 W tungsten halogen lamp (TrusTech, CHF-XM-500W) was used as a visible light source. Au electrodes were prepared through photolithography technique.

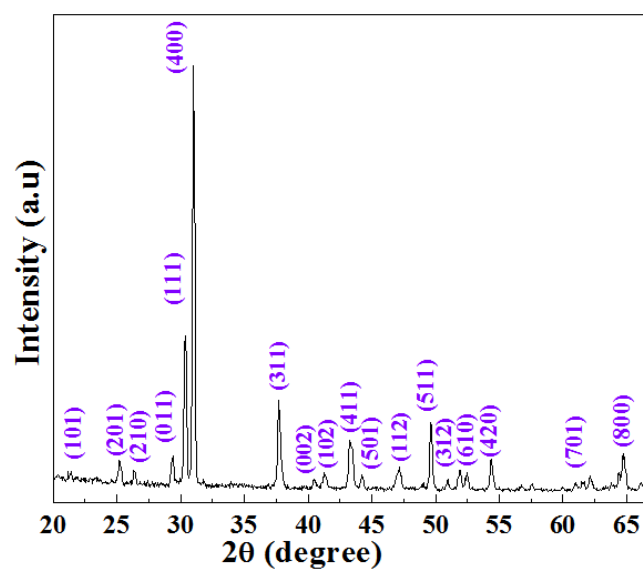
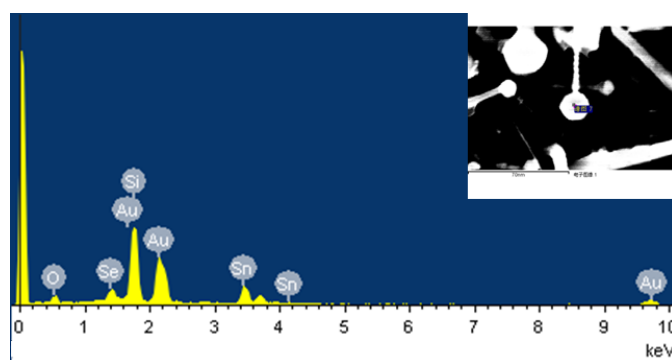


Figure S1. XRD pattern of SnSe prepared at 700°C.



FigureS2. EDS pattern of the tip of nanowires showing the presence of Au.