

Investigation of absorbance profile within n-type doped bulk sintered MoS₂

Pakmehr, Mehdi¹; Dehghani, Parnian¹

¹ Department of Physics (Eram Campus), Shiraz University, Shiraz 71946, Iran



Introduction

- Molybdenite (MoS₂) Known mineral as a novel semiconducting material with Indirect gap ($E_G=1.3$ eV) & High dielectric constant
- Interesting Mechanical, Optical & transport properties make MoS₂ an ideal candidate for Si substitute within (Opto)electronic technology
- High melting point (2500 K) make it difficult to fabricate MoS₂ in bulk morphology, Our sample Prepared using Spark Plasma Sintering (SPS) technique

Method

- Combination of High P (90 MPa) + High Temperature (2100 K) being used in SPS technique to make 1" coin shape sample (See Figure 1)
- Different characterization technique including SEM, PXRD, Hall, Ferq. Response, PIXE used to investigate the physical properties of fabricated sample
- Optical Properties including absorbance profile obtained using Czerny-Turner set-up discussed in this poster



Figure 1) Optical, micrograph (X 10) & SEM (X 4K) images of Sintered sample

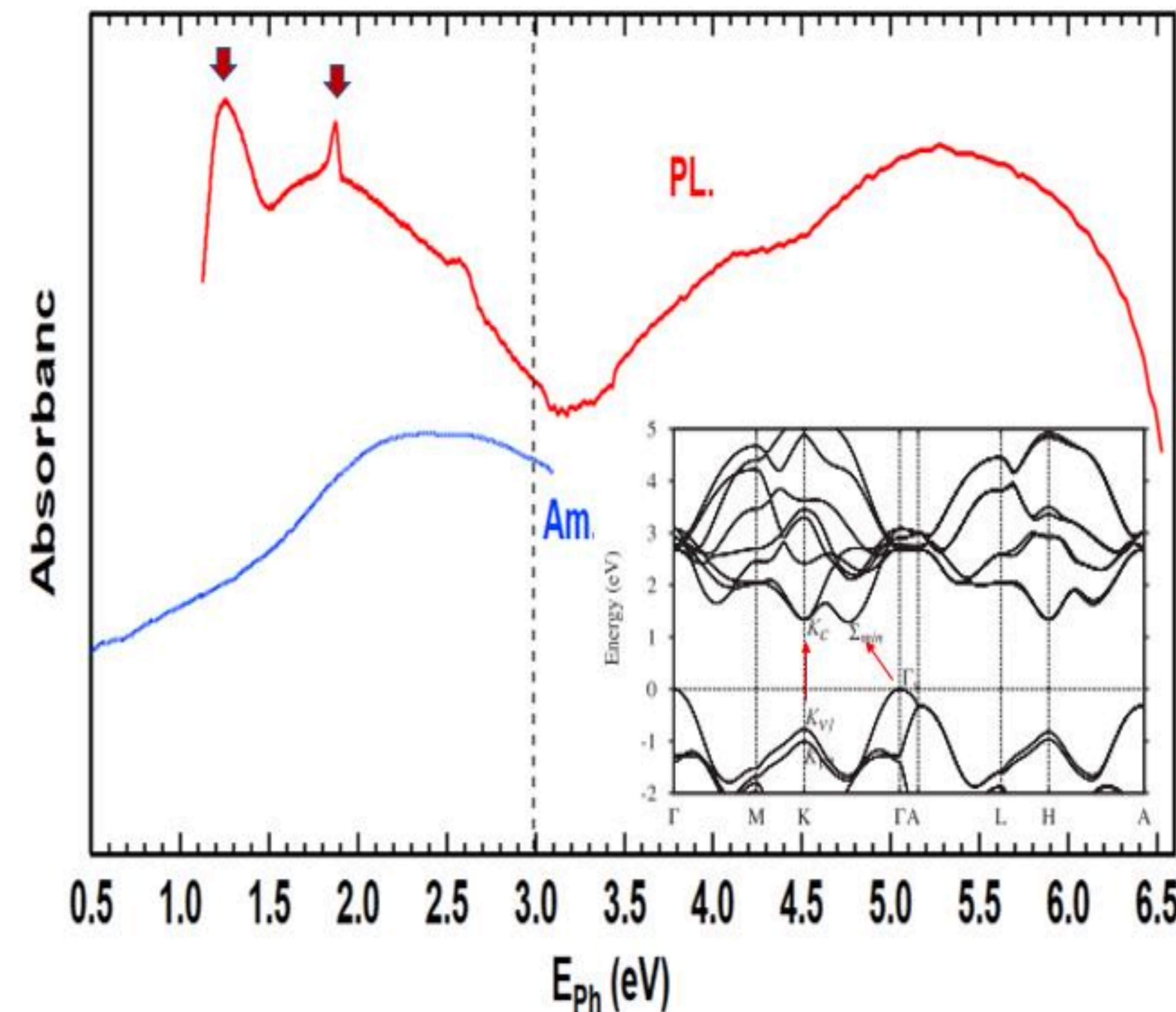


Figure 2) Absorbance Profile of Sintered samples

Table 1 – Interband transition (eV)

Transition	Theory	Reported	Ours
$\Gamma \rightarrow \Sigma$	1.287	1.29	1.256
$K_V \rightarrow K_C$	2.099	1.88	1.875

Table 1:
Optical Interband transition energies for Bulk MoS₂:
QP DFT based calculation & Experimental values.

Results

- Absorbance profile of sample using Czerny-Turner set-up @ wavelength range of: $190 < \lambda < 1100$ nm, UV-Vis-NIR spectrum
- For Polycrystalline sample distinct peaks @ **1.256 & 1.875** eV due to Interband transitions @ Γ & K point of BZ
- For Amorph sample no abs. Peaks and smooth profile
- No Spin split Interband transition peak @ K point observed

Discussion

- Bulk n-type doped MoS₂ sample made through SPS technique in polycrystalline format
- Optical absorbance profile might be used to distinguish Amorph & Polycrystallinity phase of sample
- One might probe adding proper dopants to make absorbance profile ideal for photovoltaic sustainable energy harvest

References

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