

Enhancing the Seebeck coefficient of Zn-doped MoS₂ grown over carbon fabrics via band engineering

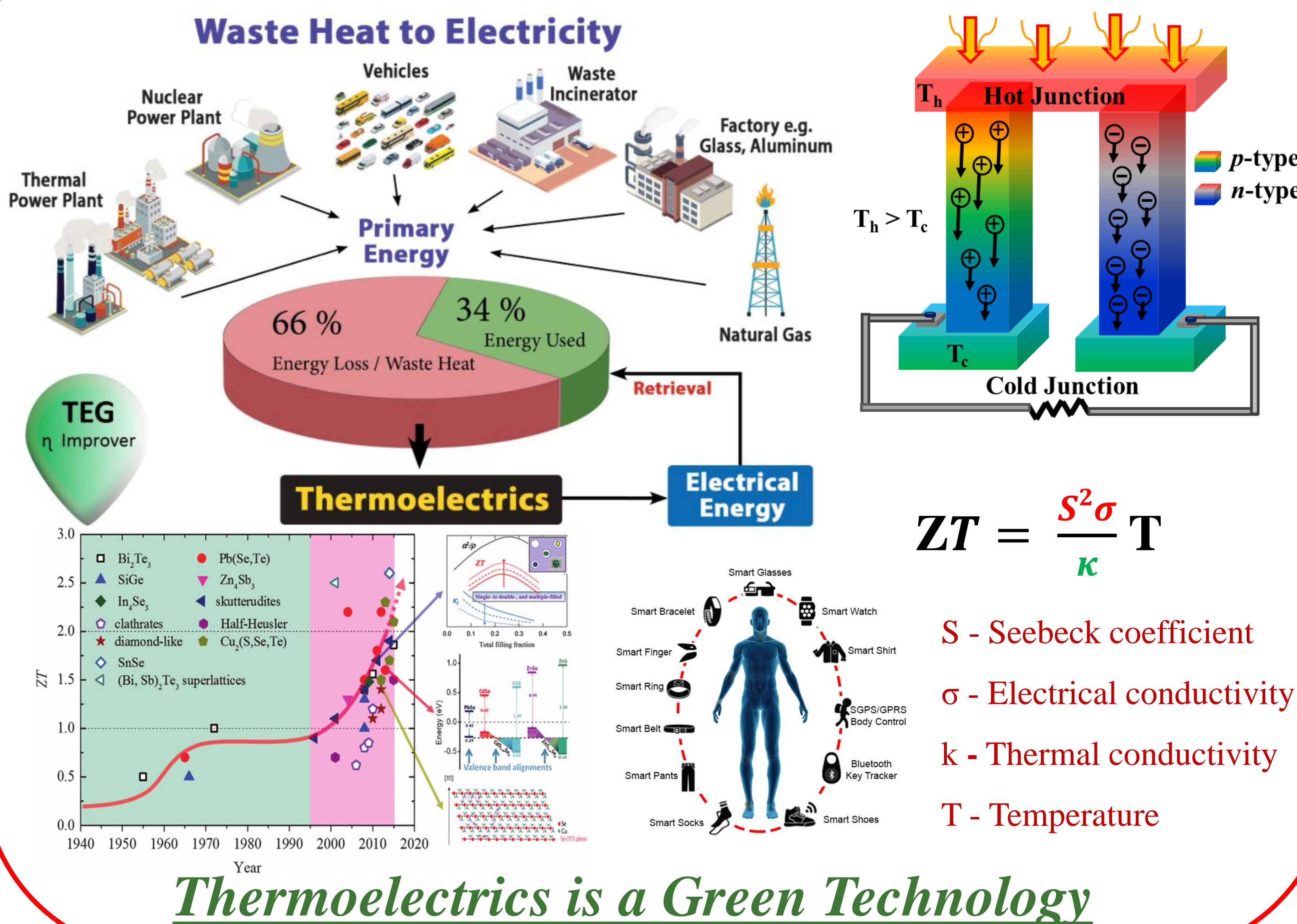
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Background



Material Properties

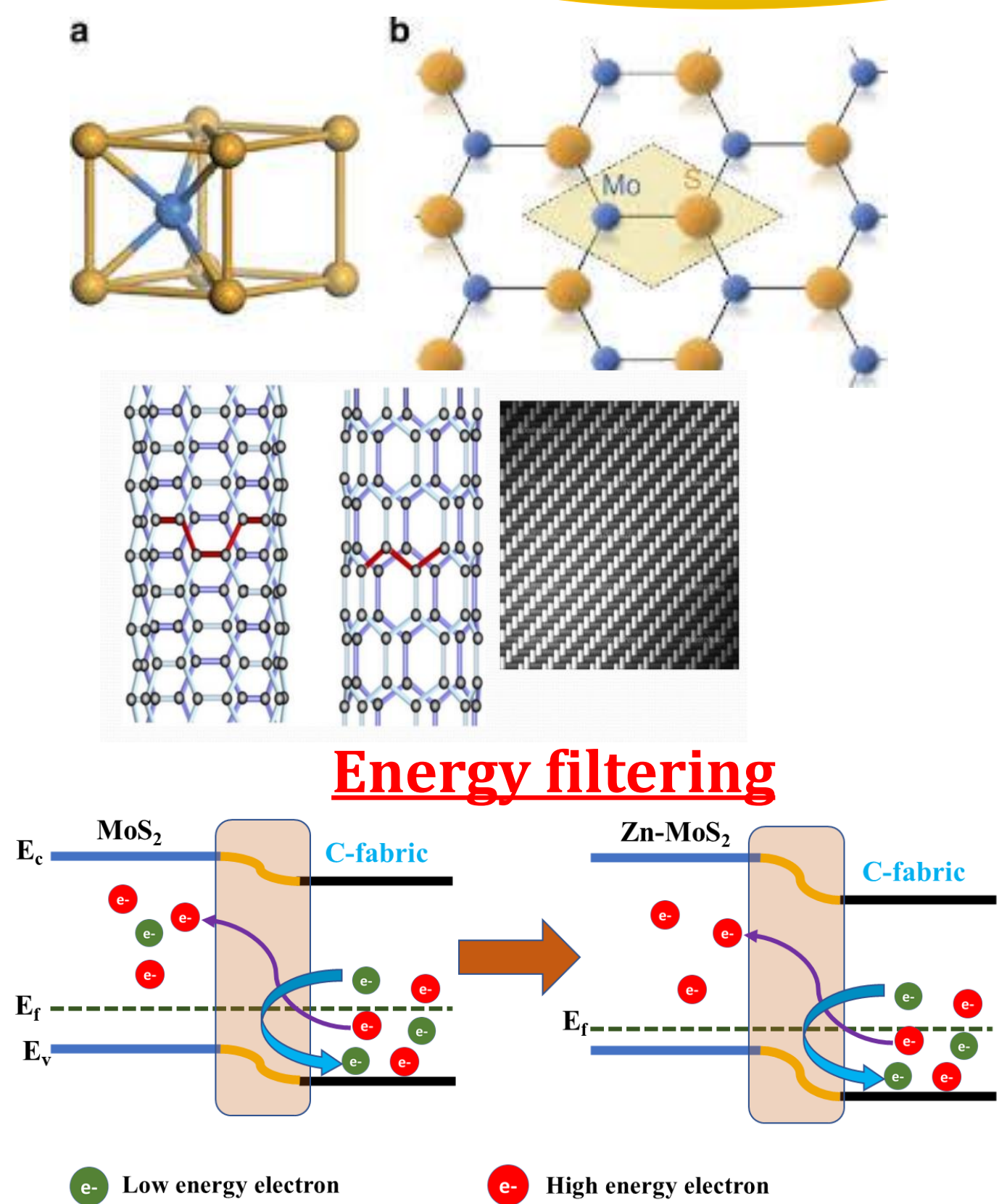
Properties of MoS₂

- Good chemical stability and thermal stability
- Low thermal conductivity
- Low cost
- Bandgap of around 1.2 to 1.9 eV

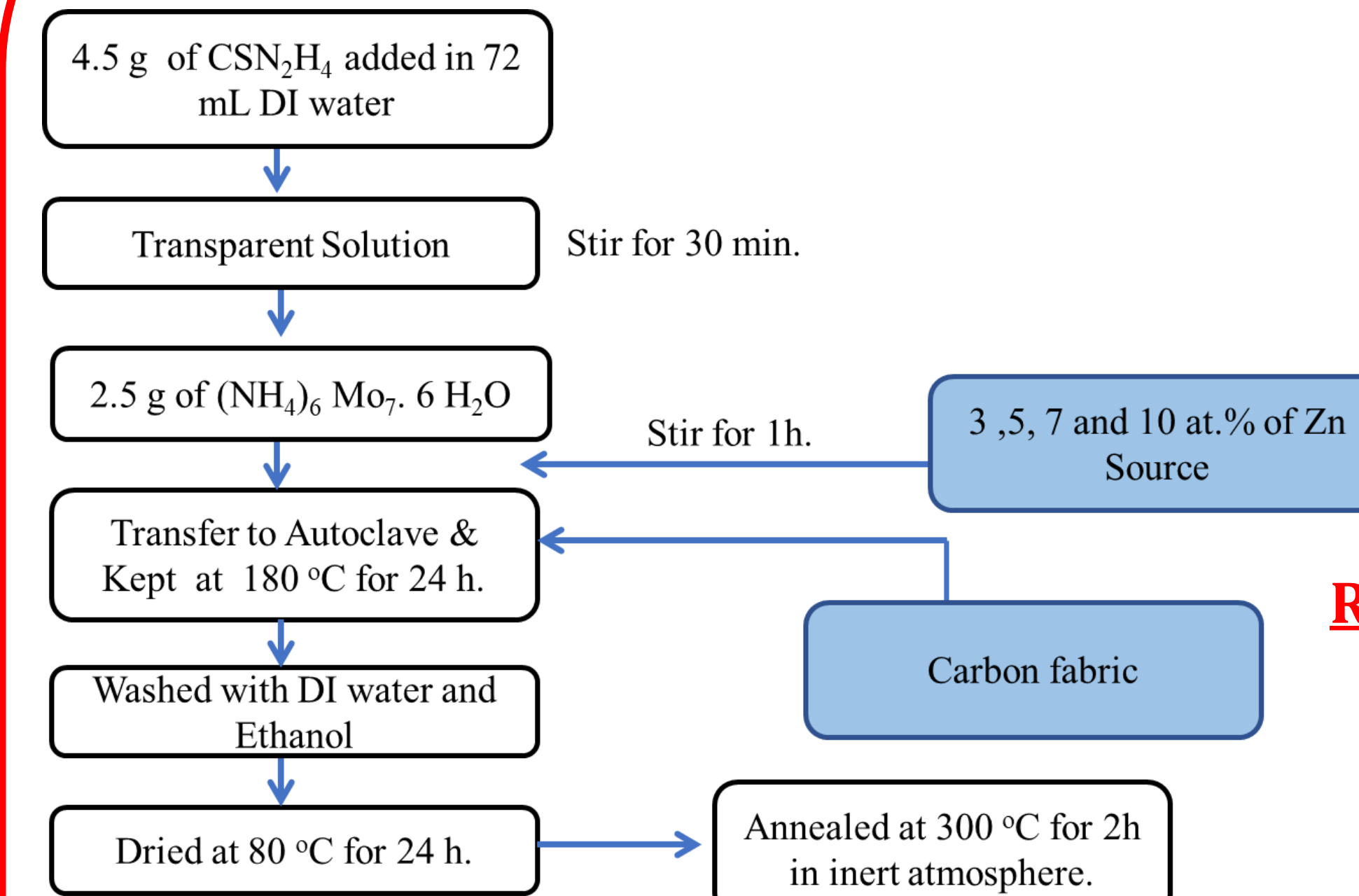
Carbon Fabric

- Good conducting material
- Flexible
- Heat resistant
- Good adsorbing property

Structure

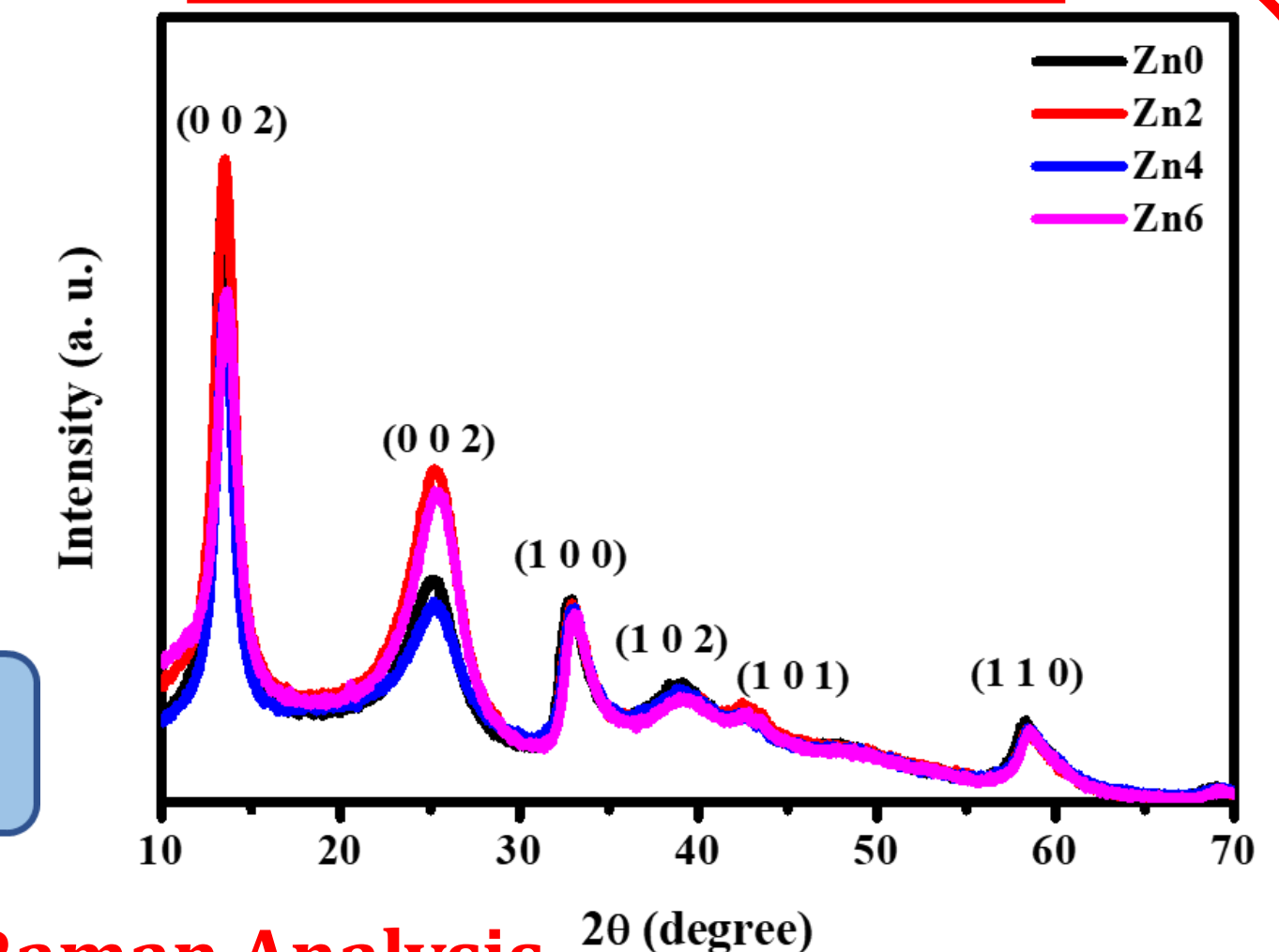


Synthesis Procedure

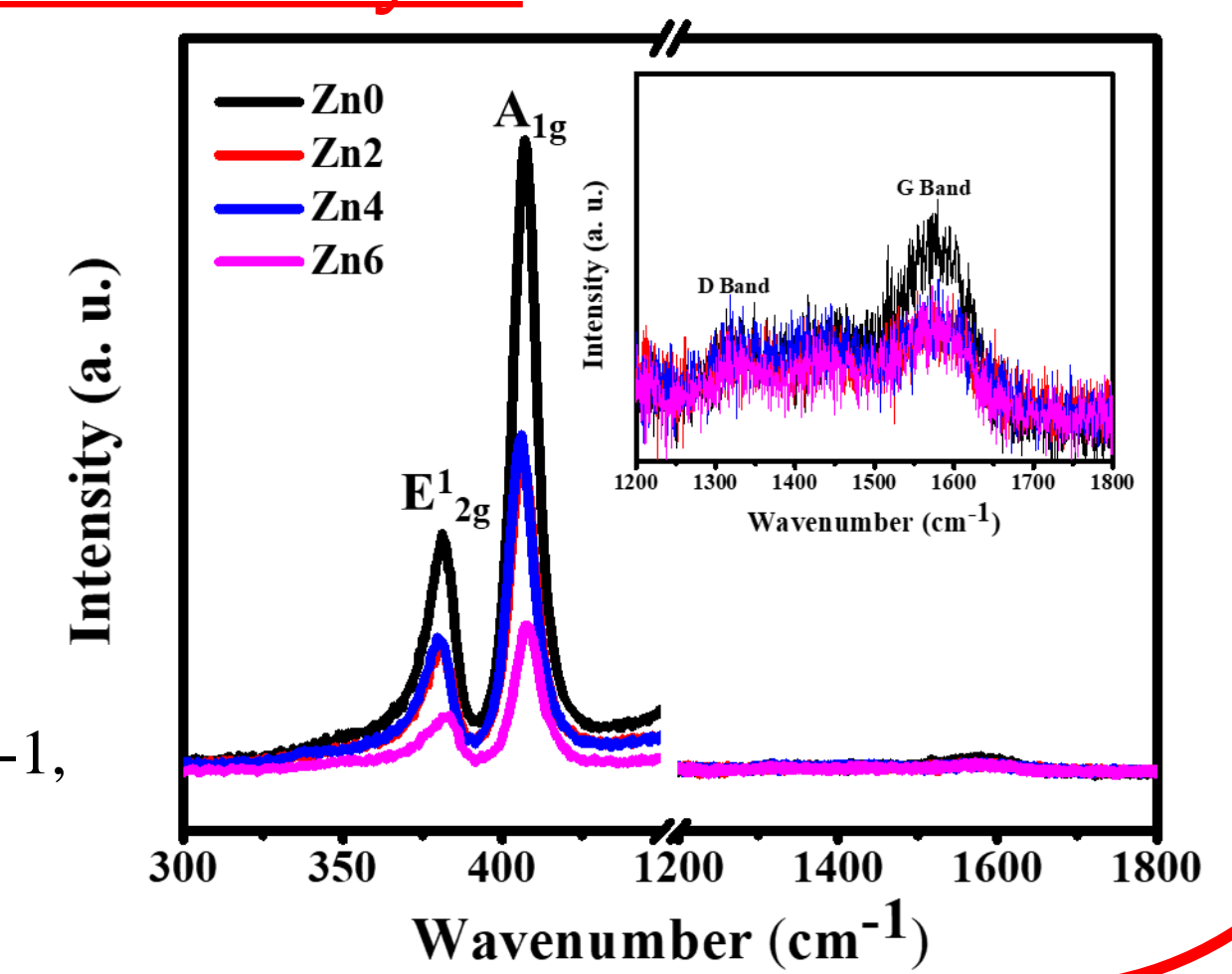


- The peaks located at $2\theta = 13.13^\circ, 32.23^\circ, 35.28^\circ$, and 57.27° have been assigned to the (0 0 2), (1 0 1), (1 0 2), and (1 1 0) planes of the hexagonal MoS₂ phase- JCPDS file number 01-075-1539
- Raman spectra of MoS₂@CF and Zn-MoS₂@CF, the peaks at 378 cm⁻¹, 404 cm⁻¹, 1330 cm⁻¹ and 1574 cm⁻¹ corresponding to E₁g mode, A₁g mode, D band and G band, respectively.

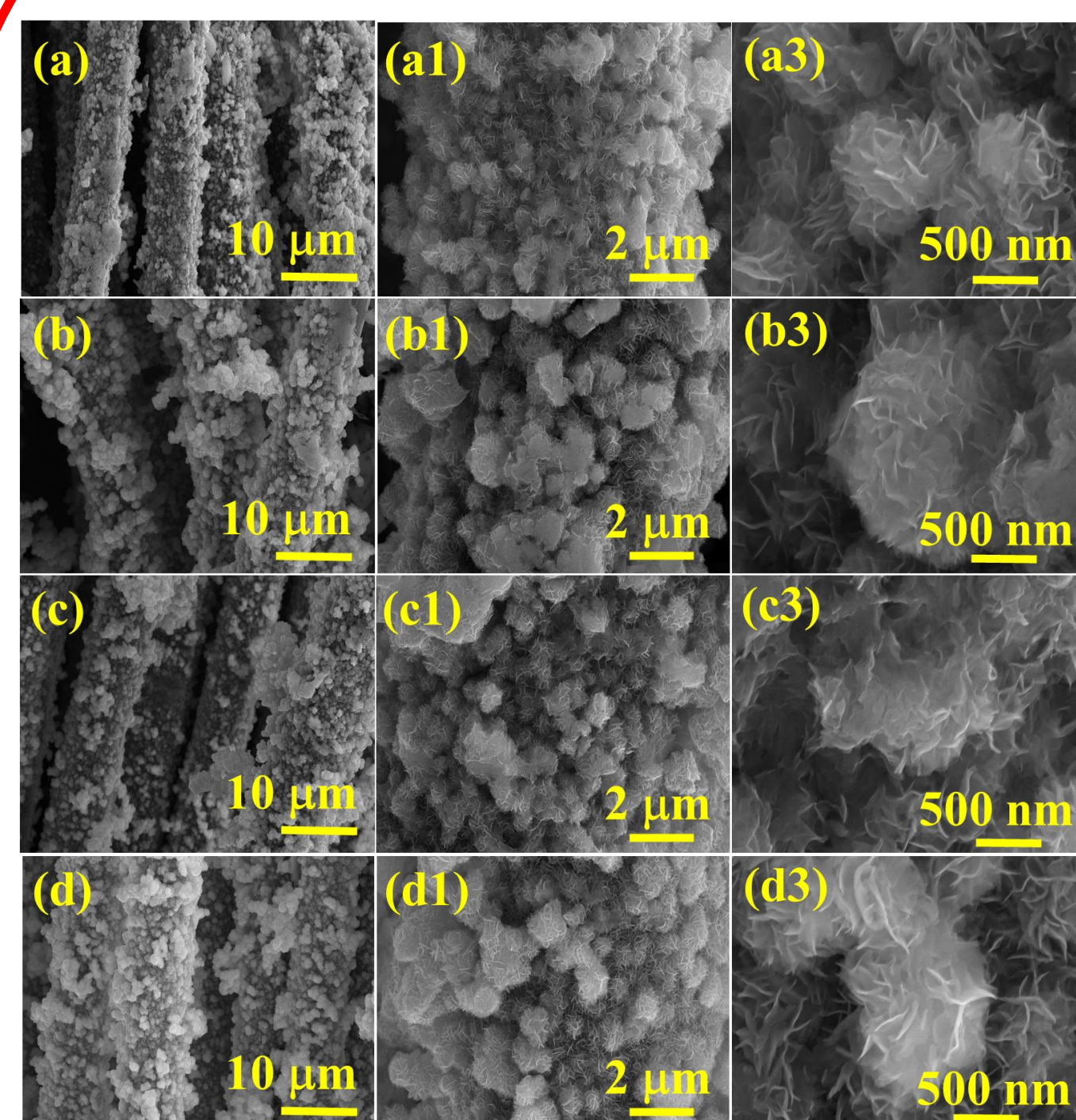
Structural studies - XRD



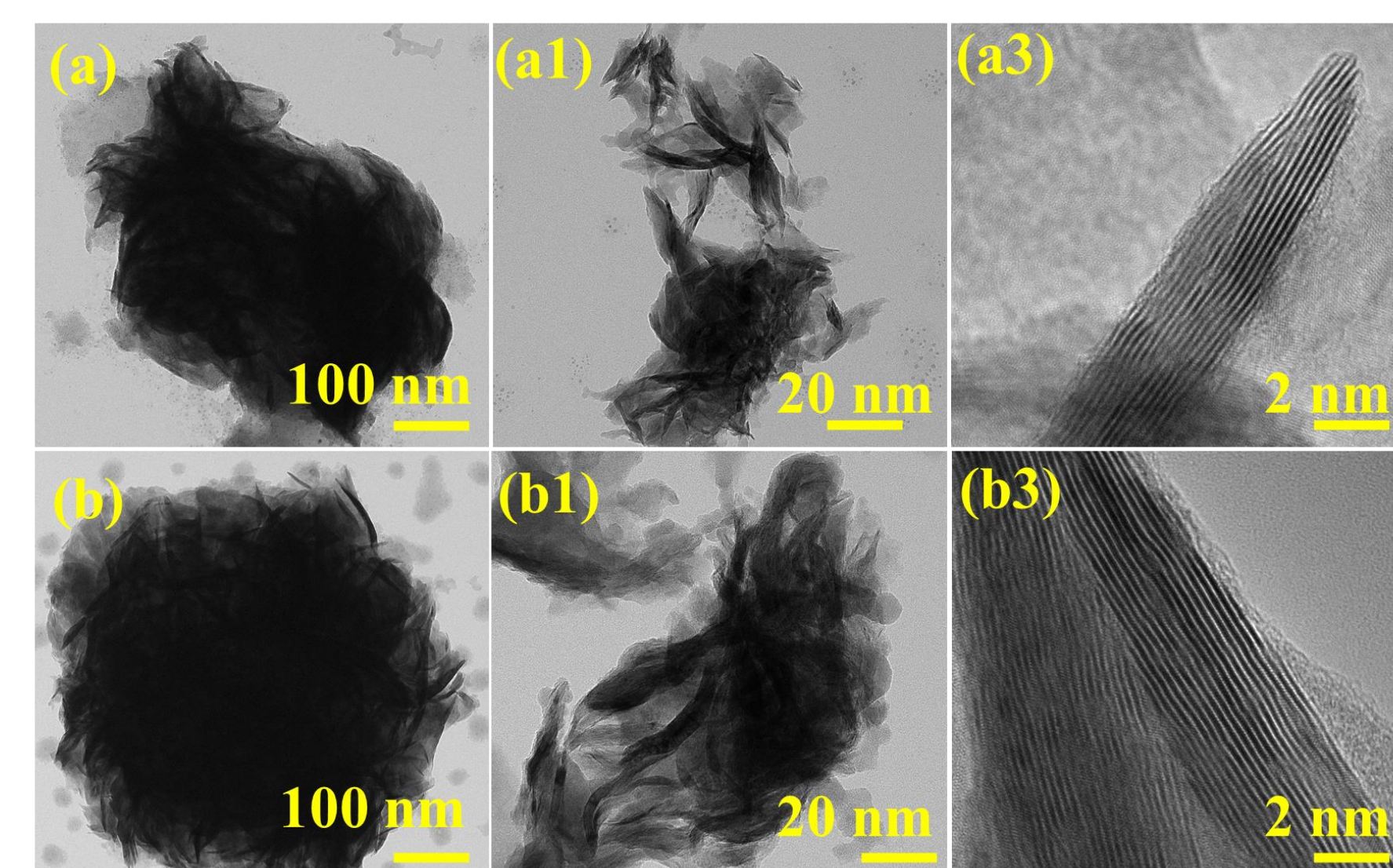
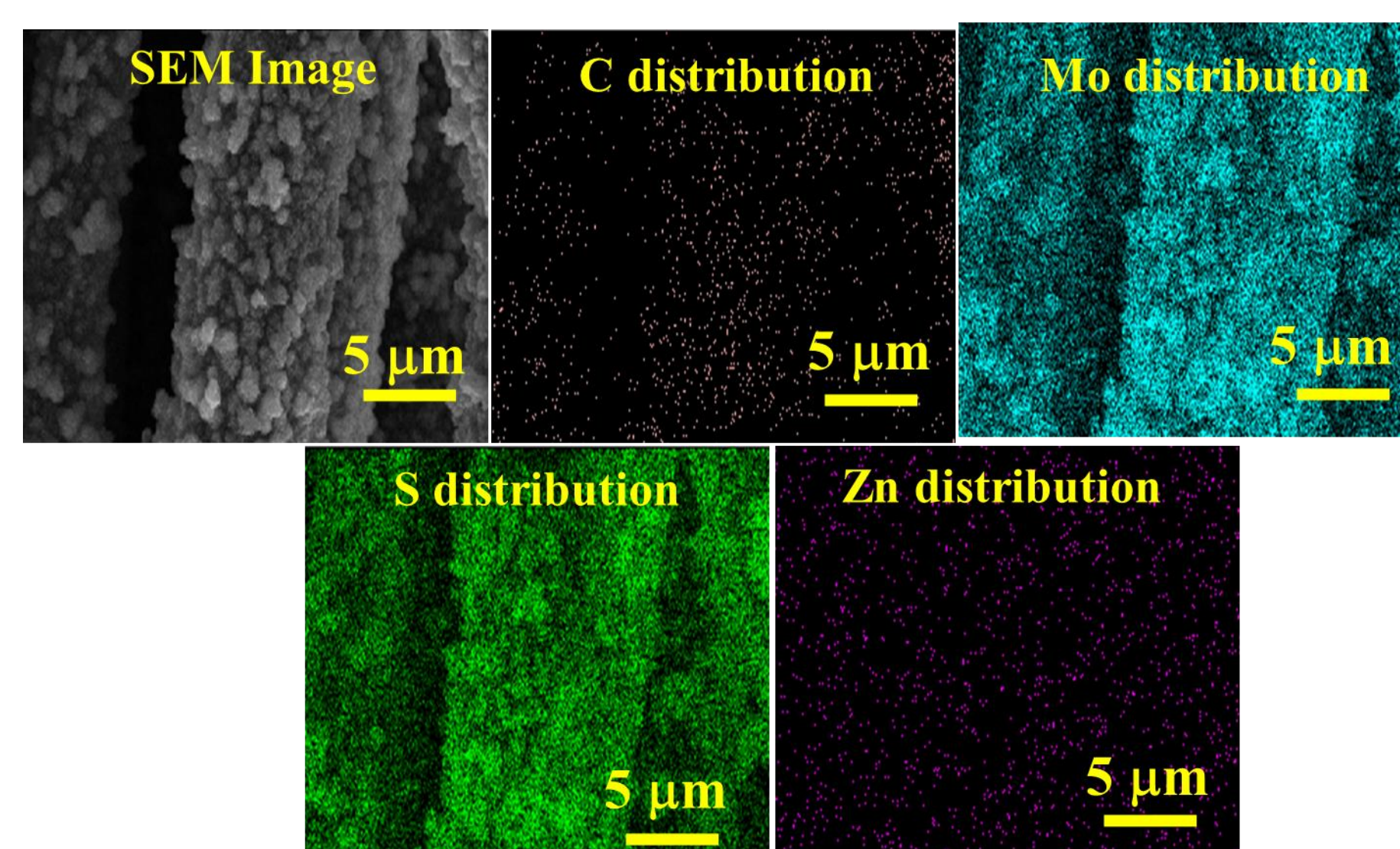
Raman Analysis



Surface Analysis

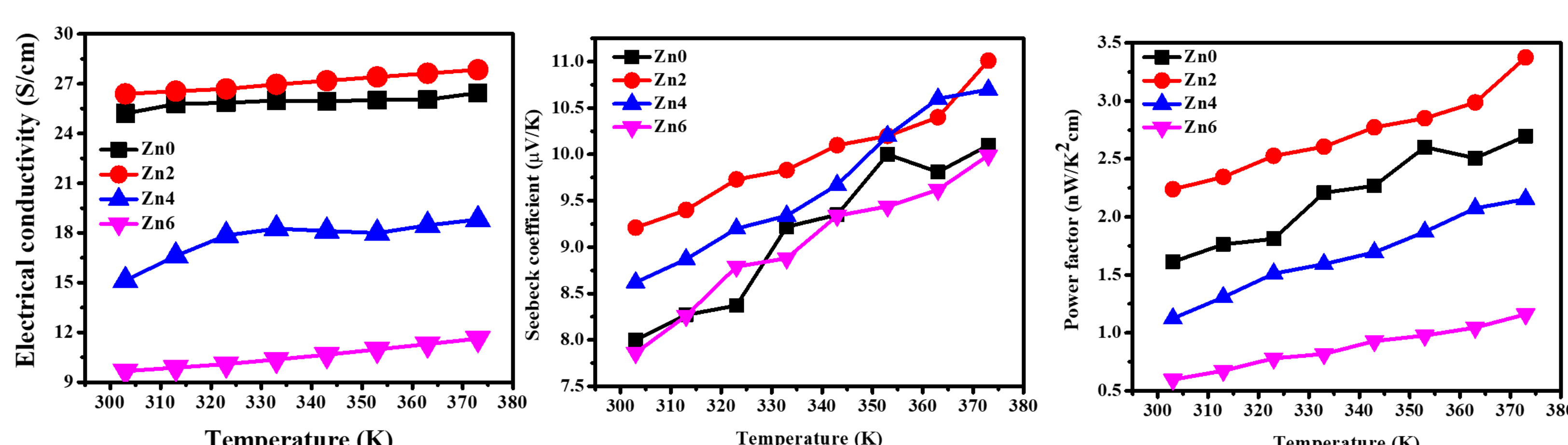


Elemental Mapping



- Pristine MoS₂ and Zn doped MoS₂ showed flower-like morphology by interweaving the nanosheets of MoS₂
- The analysis showed the uniform growth of pristine and Zn doped MoS₂ over carbon fabric
- Elemental mapping of Zn6
- TEM and HR-TEM of Zn4 and Zn6

Thermoelectrics-Thermal conductivity



- The maximum electrical conductivity obtained was 27.8 S/cm for the Zn2 sample.
- The maximum Seebeck coefficient was around 11.01 μV K⁻¹ has been achieved for 2 at% of Zn doped MoS₂ (Zn2).
- Maximum power factor was 3.37 nW/K²cm

Conclusion

- Pristine and Zn doped MoS₂ nanosheets grown on carbon fabric were successfully synthesised via a one-step hydrothermal method.
- Structural and morphology analysis confirmed the formation of layered MoS₂ on carbon fabric.
- Compositional analysis confirmed the interaction between carbon fabric and MoS₂
- The maximum electrical conductivity obtained was 27.8 S/cm for the Zn2 sample.
- The maximum Seebeck coefficient was around 11.1 μV K⁻¹ has been achieved for 2 at% of Zn doped MoS₂ (Zn2).

Future work

