SURFACE MODIFICATION OF ZINC OXIDE NANORODS USING 3-GLYCIDOXYPROPYLTRIMETHOXYSILANE

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Introduction

- ZnO is a key functional material exhibiting
  - Near Ultra Violet emission
  - Transparent conductivity
  - Semiconducting, magnetic and piezoelectric properties
- It has a
  - Wide direct band gap (3.37eV) &
  - Large excitation binding energy (3 eV)
  - Excellent chemical, mechanical and thermal stability
- Zinc oxide has extensive commercial use during the past few years
  - Optoelectronics
    - Nano/ Microelectronics
    - Sensors/ Transducers
    - Hydrogen storage materials and
    - Biomedicine

Currently, ZnO is considered as one of the most promising and novel photonic materials for the blue, violet and UV regions.

- Therefore, ZnO naoparticles have been used in;
  - **Chemical sensors, thin film photovoltaic solar cells and piezoelectric and luminescent materials.**
  - **Varistors**
  - **Transparent UV-protection (Sunscreen)**

- This unique feature of ZnO provides some superior properties to sunscreens
  - **High Sun Protection Factor (SPF)**
  - **Broad Spectrum coverage in sunscreen**
  - **Reduce the potential irritability**

- The photocatalytic activity

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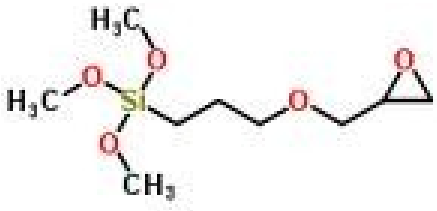
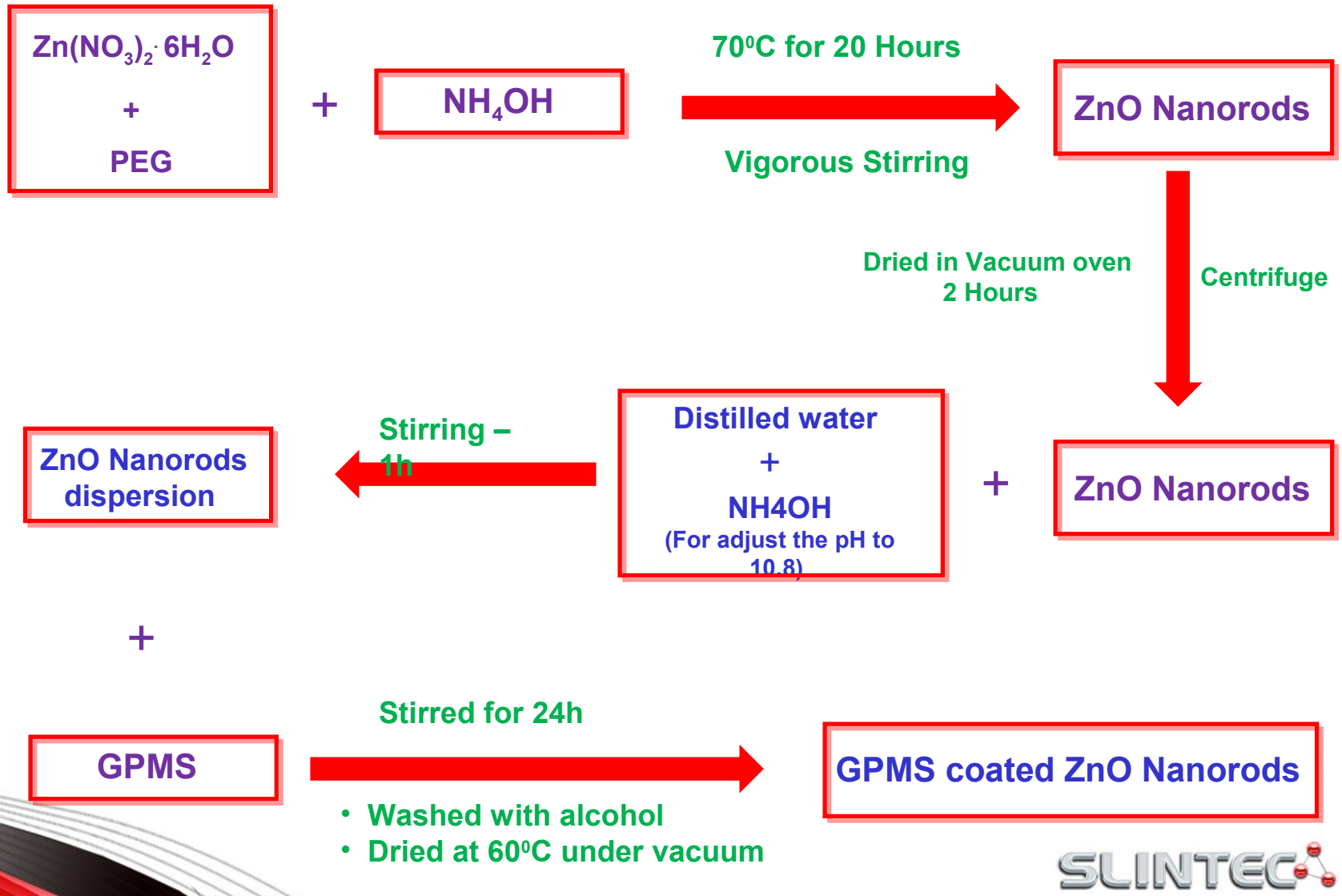
Therefore, many researches are interested in synthesizing different types of ZnO nanorods for various applications.

- In this study, ZnO nanorods were coated with 3-Glycidoxypropyltrimethoxysilane (GPMS) under basic conditions.
- Studied (Compared) the optical and morphological properties of coated and non-coated powder using different analytical techniques
  - **UV- Visible Absorption Spectroscopy**
  - **Fluorometry**
  - **Powder X-Ray Diffraction (PXRD)**
  - **Scanning Electron Microscopy (SEM)**



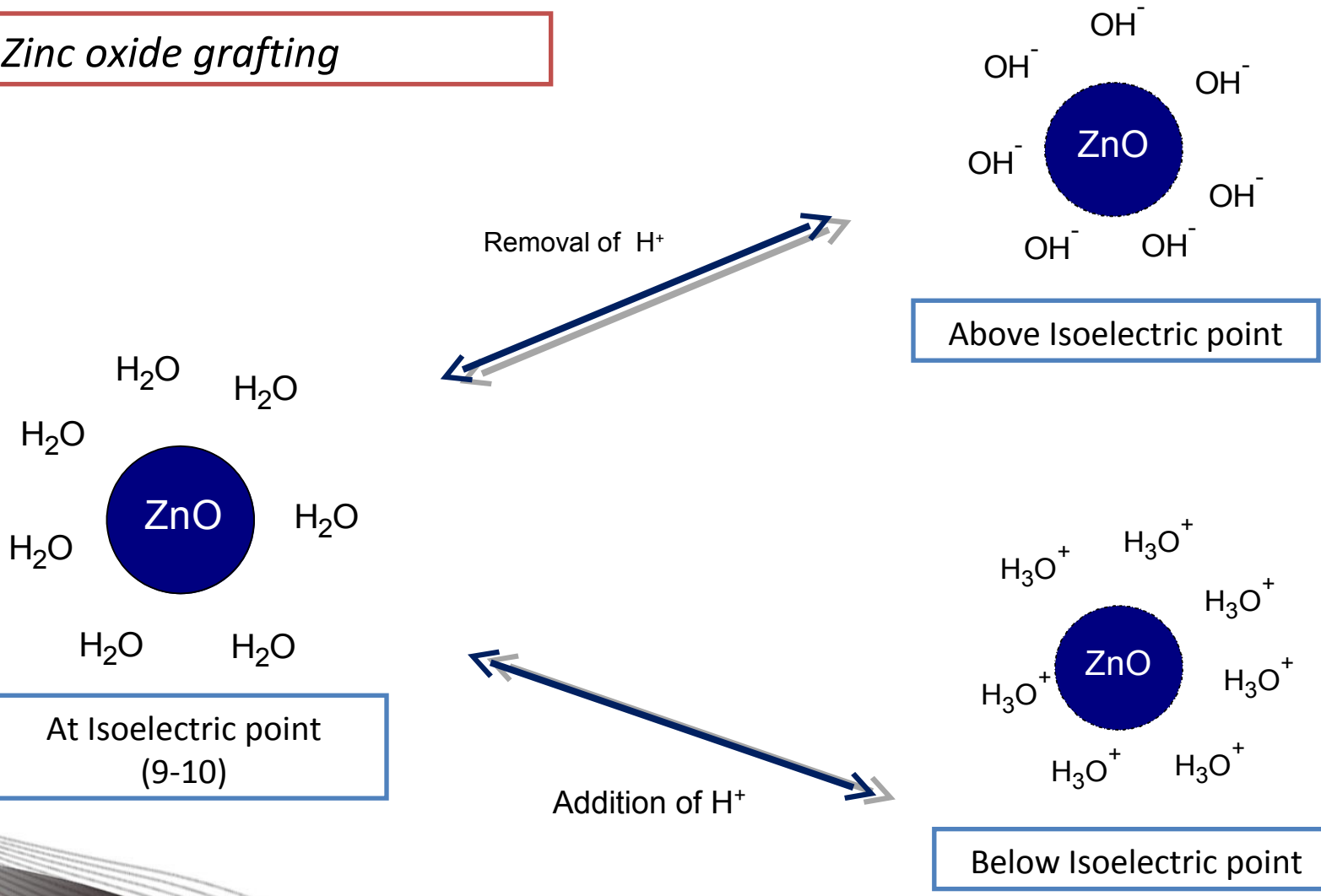
Chemical Structure of 3-Glycidoxypropyltrimethoxysilane (GPMS)

Methodology



Results and Discussion

Zinc oxide grafting



Above Isoelectric point

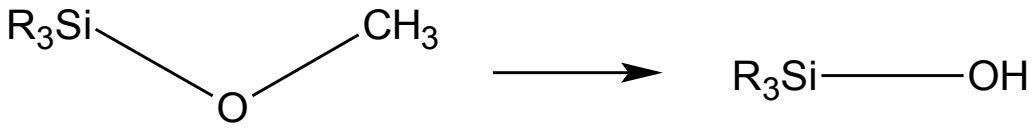
At Isoelectric point (9-10)

Below Isoelectric point

Contd…….

At pH around 10.5,

- ZnO surface negatively charged.
- Silane hydrolyzed to silanol and condensation to siloxane .



- Though it is not a preferential attraction, silanol deposit on the surface of ZnO in the presence of high Si% [2].

Morphology of samples

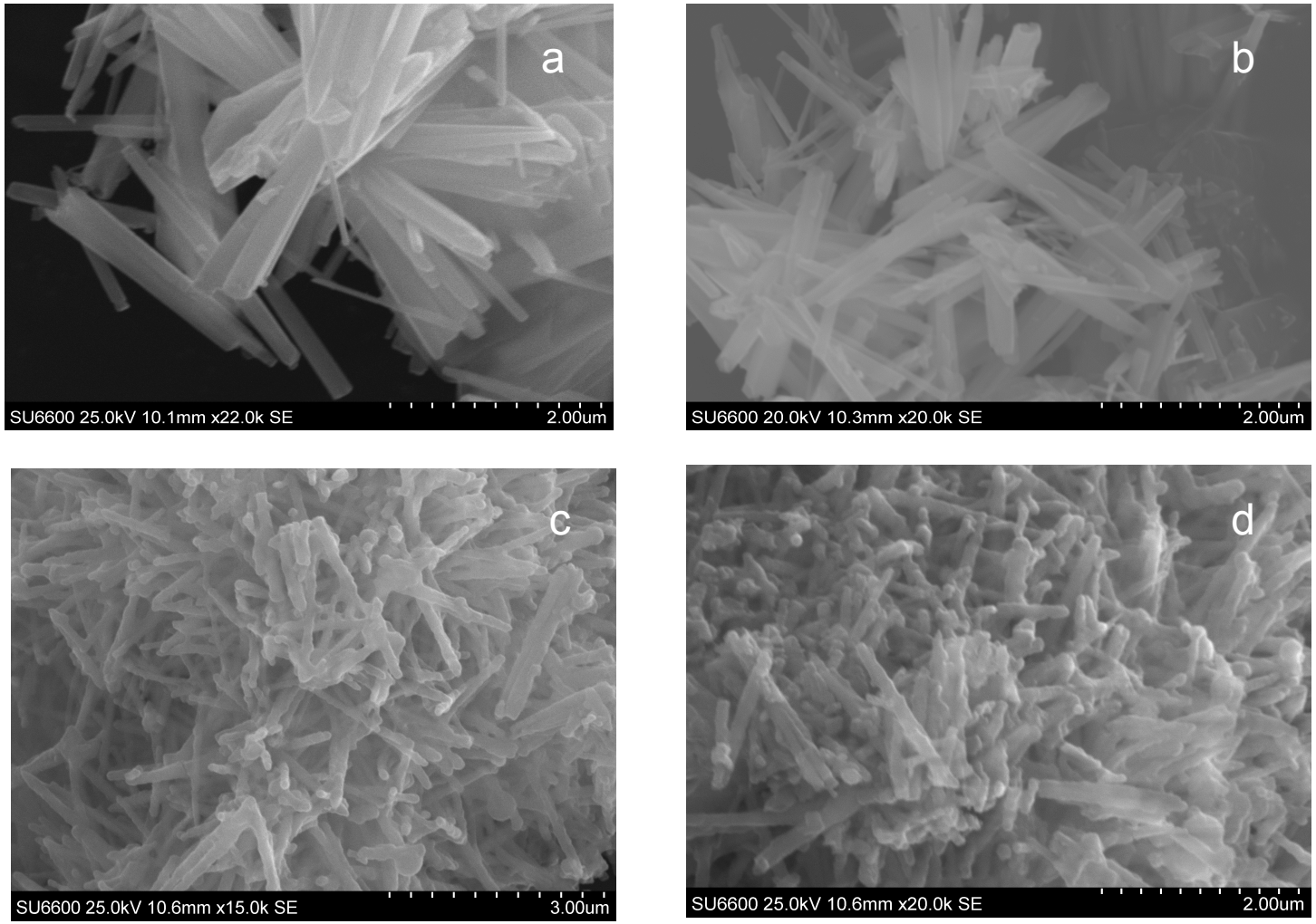


Figure 1: SEM images of (a-b) uncoated (c-d) coated ZnO nanorods

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XRD Spectrum

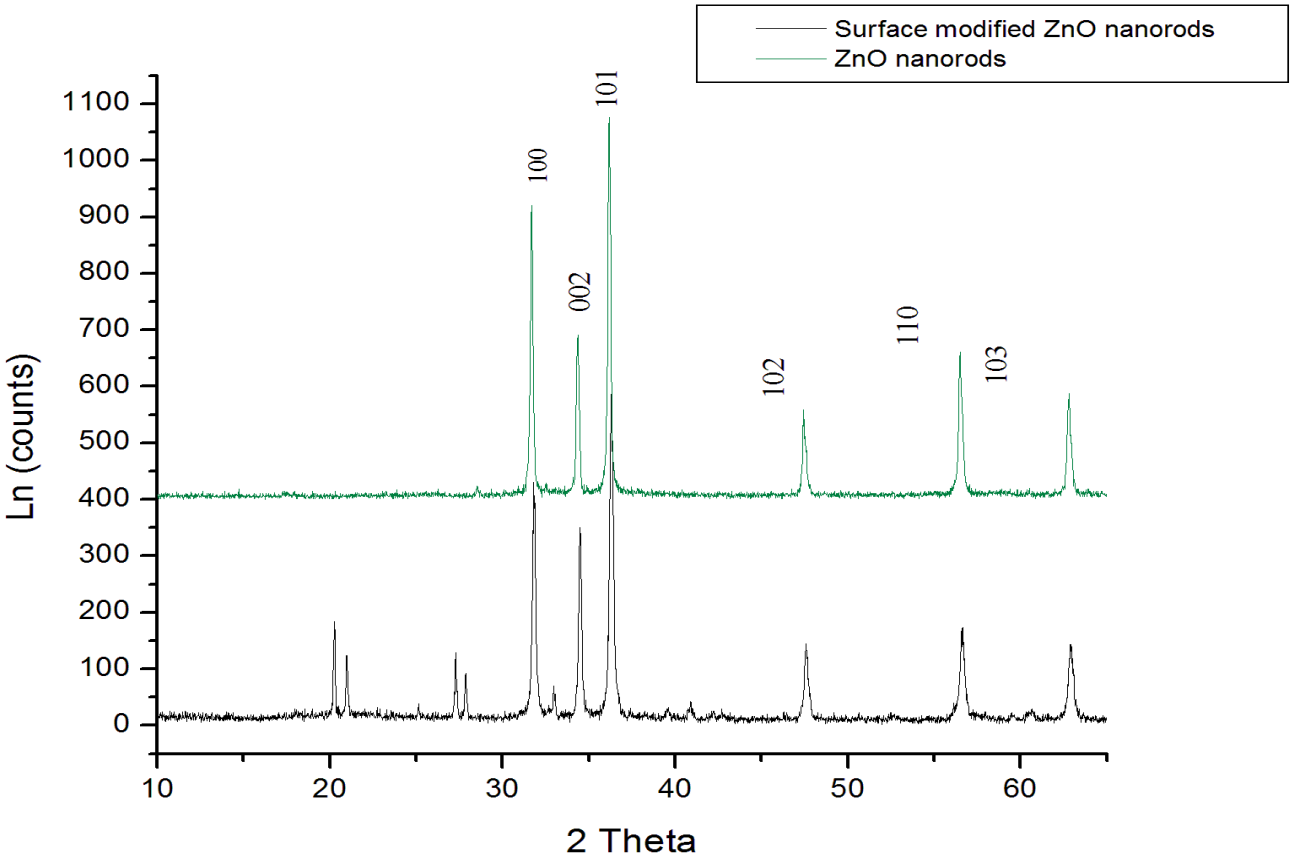

Figure 2: XRD spectrums for coated and uncoated ZnO nanorods

Diffuse reflectance properties

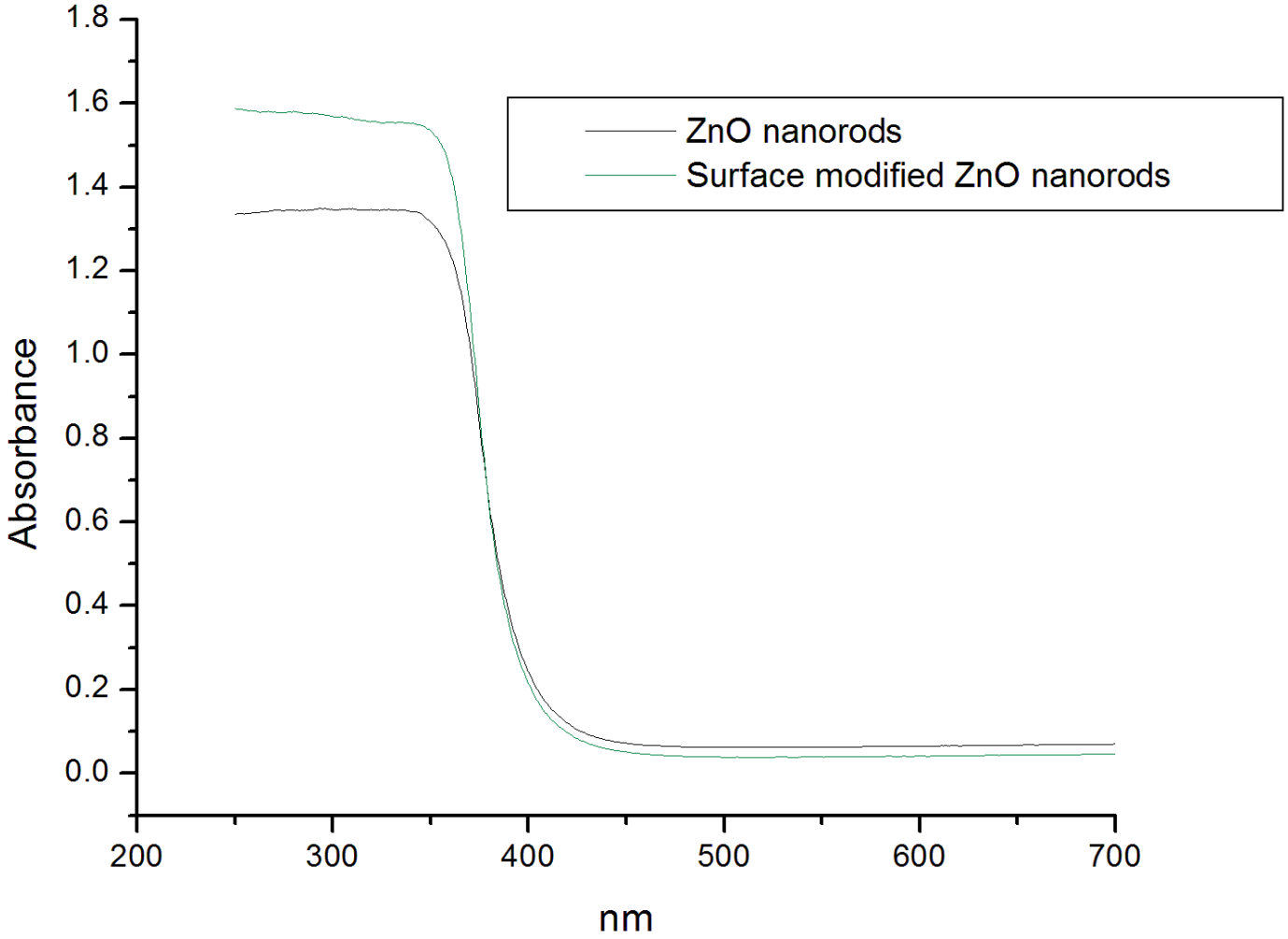

Figure 3: UV-Vis spectrums for coated and uncoated ZnO nanorods

Photoluminescence Analysis

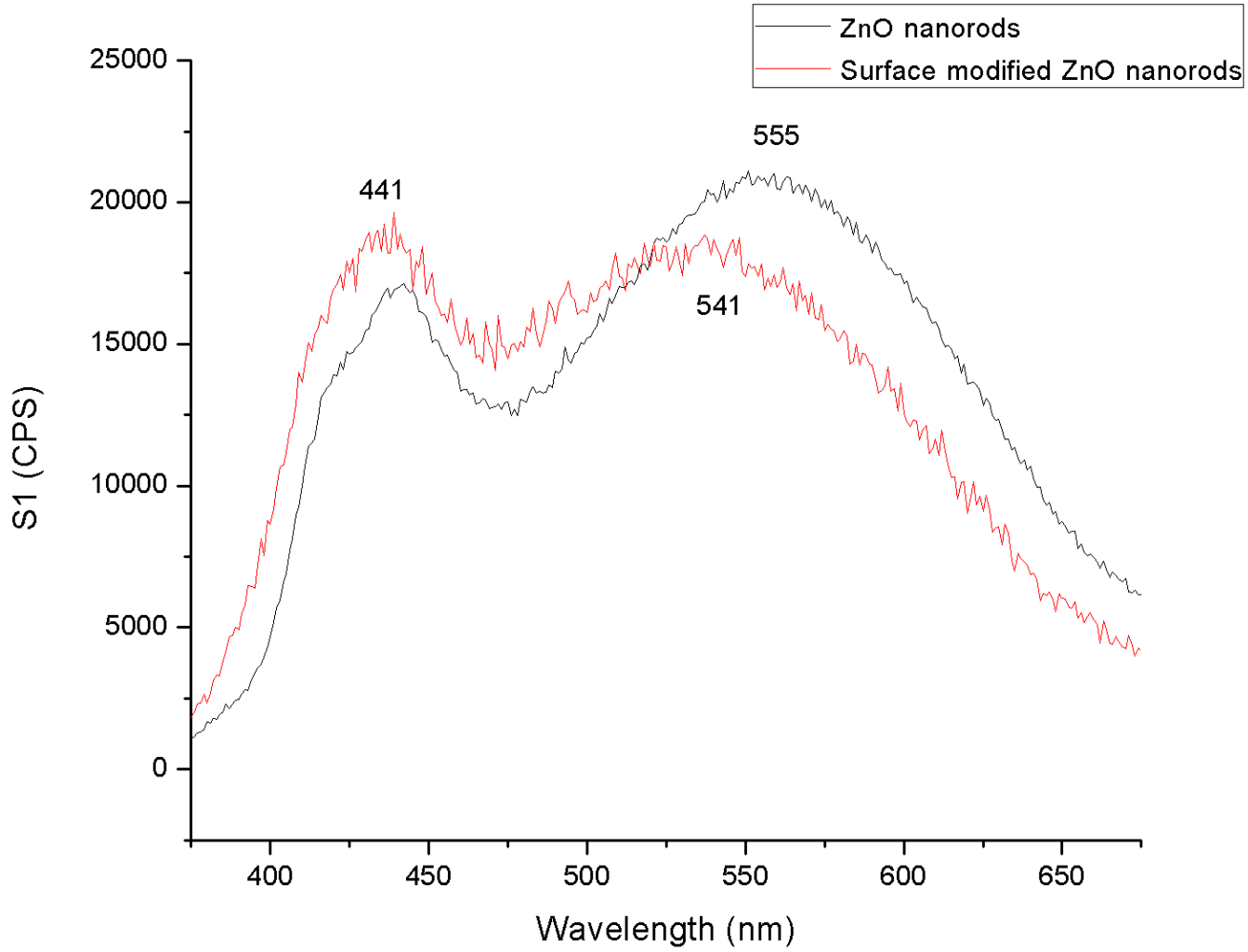

Figure 4: PL for coated and uncoated ZnO nanorods

Conclusion

- Surface of the ZnO nanorods are passivated by GPMS.
- SEM studies shows that the morphological difference in the coated and uncoated nanorods
- UV-Visible absorption shows the band gap coated and uncoated nanorods are not changed (~400nm).
- Fluorescence spectrum shows that the coating
    1. Pasivate the surface of the nanorods which enhance the fluorescence intensity of nanorods (441nm)
    2. Reduction of the oxygen vacancies

References

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THANK YOU