WELCOME

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

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SHRI MULIKADEVI COLLEGE, NIGHOJ

A

PROJECT REPORT

ON

"Synthesis and characterization of PbS thin film by chemical bath deposition method"

Guided by

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Submitted to

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FOR THE DEGREE OF BACHELOR OF SCIENCE IN PHYSICS

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INTRODUCTION

- There are number of types of thin film devices. This technology used in optical devices and semiconductors, through there are other application.
- In the field of optics, the thin film devices used are in the various optical filters. Optical filters are used in photography , telescopes and microscopes.
- Semiconductors are another type of thin film device. These conduct low level of electric current. Semiconductors devices are used in the field of microelectronics and integrated circuits.
- A solar cell uses a thin film semiconductor containing a dye that are sensitive to radiation from the sun . When dye absorbs photons , it creates electric charge.

THIN FILM DEPOSITION

CHEMICAL DEPOSITION TECHNIQUE

CBD's can further divided into ,

1. Spray Pyrolysis
2. Spin Coating
3. Sol-gel method
4. Chemical Bath Deposition

CHEMICAL BATH DEPOSITION TECHNIQUE

The chemical bath deposition is chemical liquid phase which one of the cheapest method to deposit thin film and nanomaterial's .

The equipment required for this are ,

1. Chemical bath
2. Magnetic stirrer
3. Thermometer
4. Subtrate holder
5. Magnetic needle

ADVANTAGES OF CBD METHOD

1. It is very simple , easy to construct and thin film of PbS can easily deposited by using CBD method.
2. It contain only solution container and subtrate mounting device.
3. The contruction cost is also less.
4. This method not required vaccum system or any sophisticated instrument.
5. This method not required very high temperature.
6. This method is suitable for preparing highly efficient thin film in simple manner.

DISADVANTAGE

The one of the drawback of this method is the wastage of solution after every deposition .

PREPARATIPON OF SOLUTION

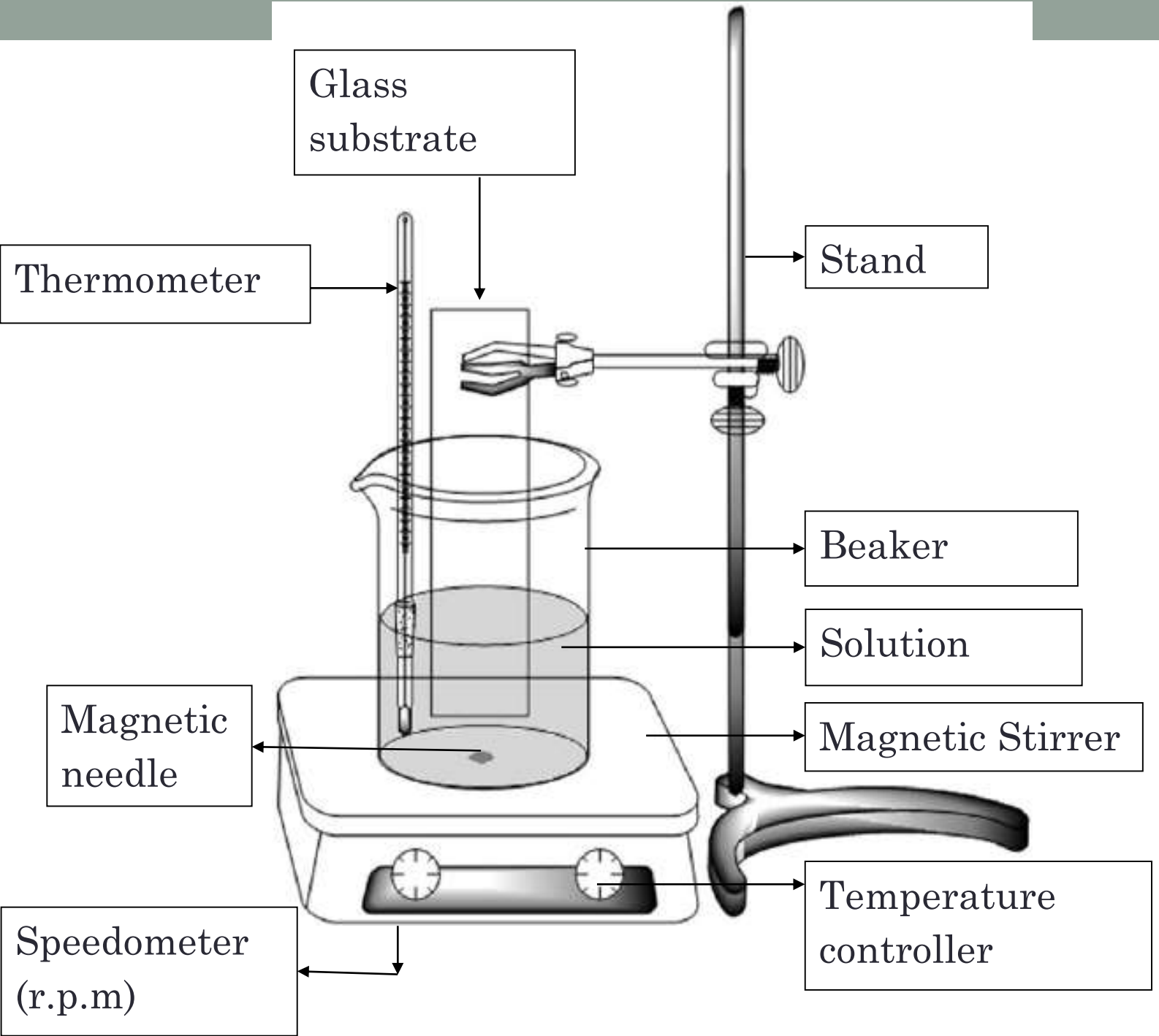
For preparing a solution following formula is used

$$X = \frac{\text{Molarity} \times \text{Molecular weight} \times \text{Volume}}{1000}$$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

WHY PBS SELECTED ?

1. PbS is semiconductor whose band gap is 0.37 to 0.41 with increase in temperature.
2. The number of electron jumping from valence band to conduction band increases , conductivity of semiconductor increases with temp.
3. The PbS thin film was deposited around 30◦C to 70◦C.
4. The solution for deposition of PbS thin film are Lead Acetate , Thiourea , Triethalomine (TEA), Sodium Hydroxide (NaOH) which are easily available and had low cost .


Glass substrate
Thermometer
Stand
Beaker
Solution
Magnetic needle
Magnetic Stirrer
Temperature controller
Speedometer (r.p.m)

EXPERIMENTAL DETAILS

- **APPARATUS**

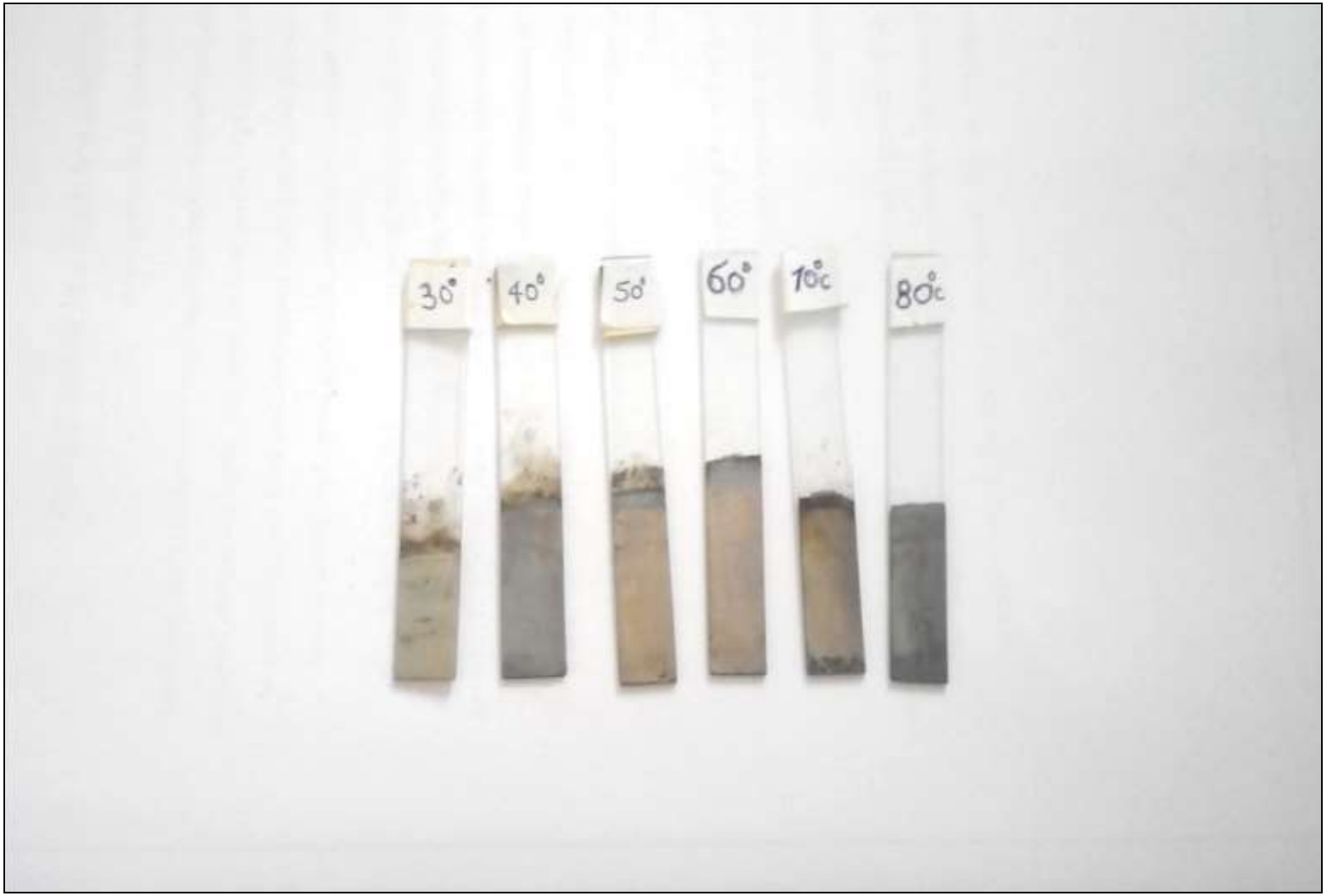
1. Magnetic stirrer
2. Glass Subtrate Holder
3. Thermometer
4. Temperature Control Knob
5. RPM Control Knob

- **CHEMICALS**

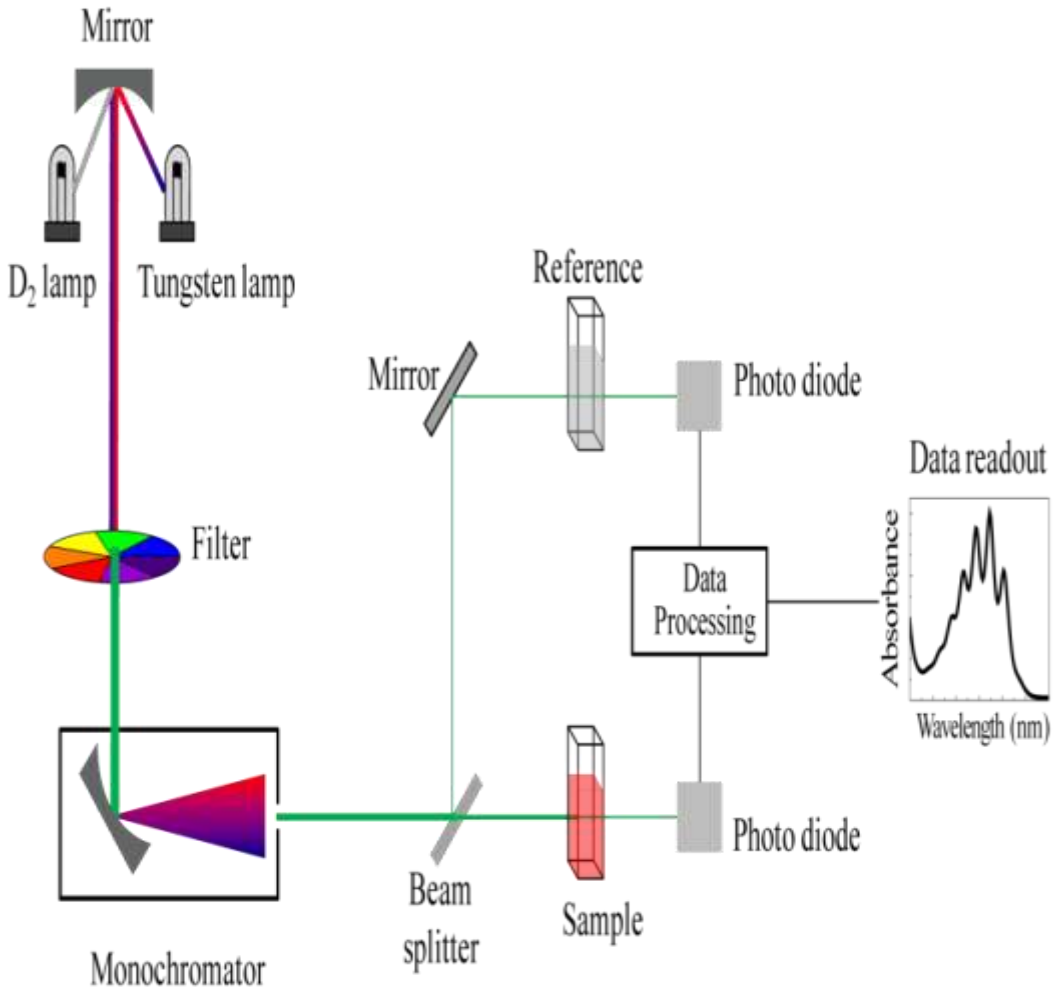
1. Lead Acetate Pb(CH3CO)
2. Thiourea (CS(NH2)2)
3. Sodium Hydroxide(NaOH)
4. Triethanomine(C6H15O3)

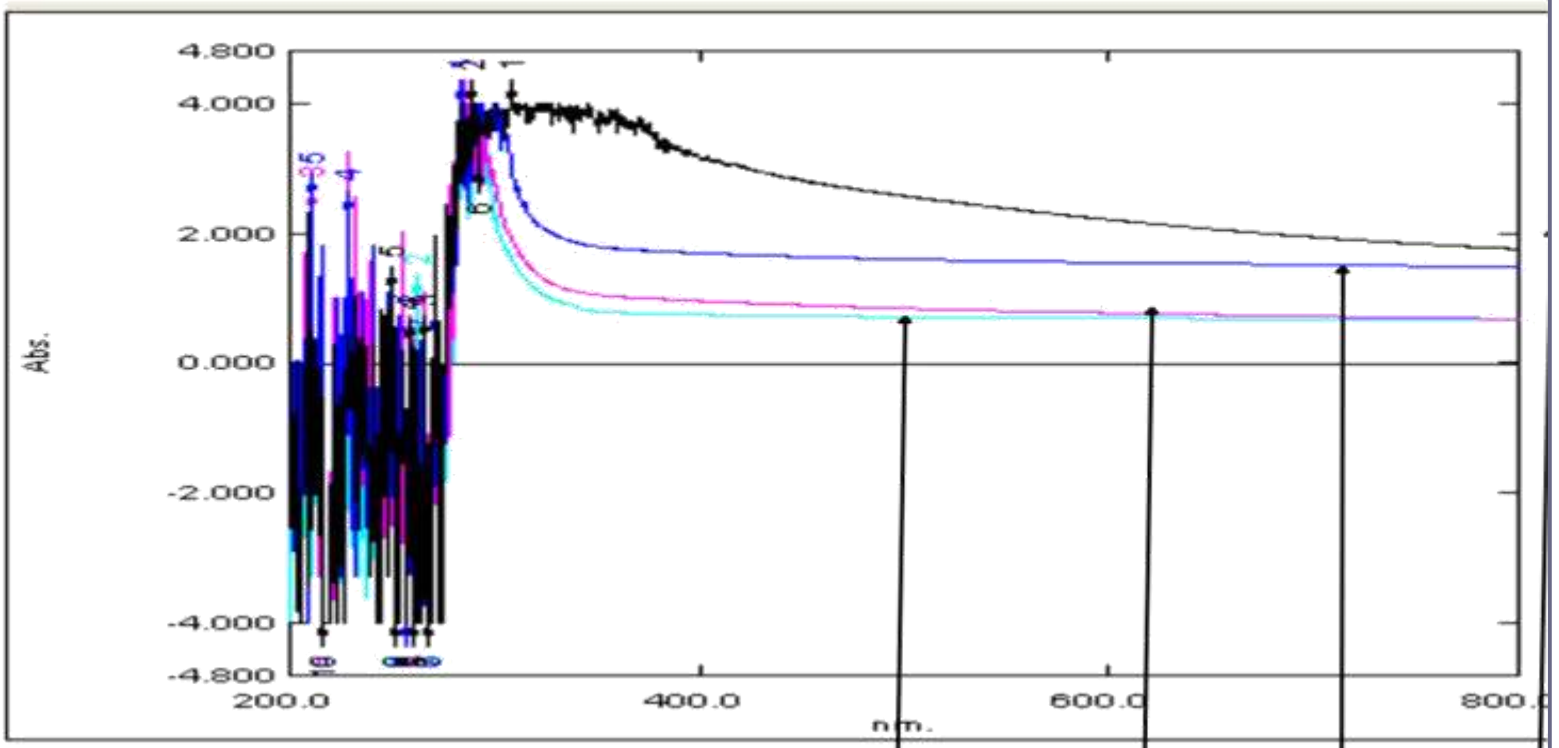
PROCESS

PBS THIN FILM BY CHEMICAL BATH DEPOSITION METHOD



U-V VISIBLE SPECTROSCOPY DIAGRAM




4.800
4.000
2.000
0.000
-2.000
-4.000
-4.800
Abs.
200.0
400.0
600.0
800.0
nm.
1
2
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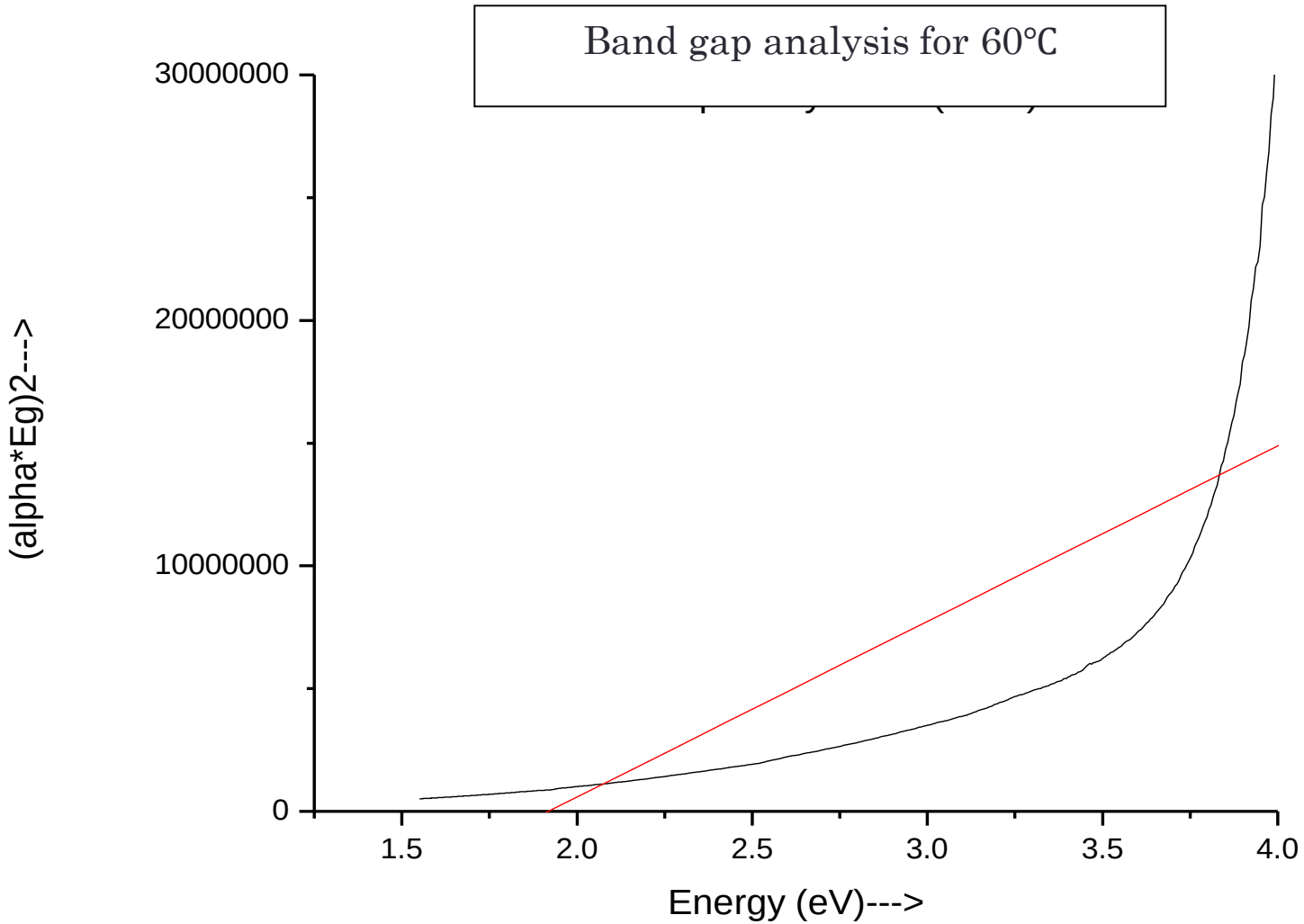
30℃ 40℃50℃ 60 ◦C



Band gap of this Thin Film is 1.6eV

RESULT AND CONCLUSION

1. By using chemical bath deposition technique (CBD) PbS thin film successfully deposited on a glass plate.
2. The thin formed is compact , uniform and well adherent on glass subtrate..
3. It is found that at 30°C deposition is minimum.
4. We conclude that at 50°C deposition of film is well.
5. The film produced is highly reflecting after 30°C.
6. Band gap of PbS thin film was successfully measured by spectroscopy.
7. The band gap of PbS thin film is,
   For 60°C=1.61 eV.
8. It concludes that the optical band gap of PbS thin film is in between 1.3 to 2.3eV.

REFERENCES

1. Nanotechnology and its application

   -by Sulabha K. Kulkarni.

2. Semiconductor Electronics

   -by A.K.SHARMA

THANK YOU