

# **INDEX**

List of Figures

List of Tables

## **Chapter – 1.      Introduction**

- 1.1. Introduction
- 1.2. Rare Earth Materials
  - 1.2.1. Properties of Rare Earth Materials
- 1.3. Thermoelectric Properties
- 1.4. Photoluminescence
  - 1.4.1. Luminescence characteristics
- 1.5. Motivation and Objectives
- 1.6. Thesis organization
- 1.7. References

## **Chapter – 2.      Literature Review**

- 2.1. Introduction
- 2.2. Literature Review
- 2.3. Conclusions
- 2.4. Choice of Materials
- 2.5. References

## **Chapter – 3.      Synthesis and Characterization Methods**

- 3.1. Introduction
- 3.2. Solid State Method

### 3.2.1. Synthesis of undoped and doped (1%, 2% and 3%

Mn, Eu, Tb) samples of Cerium Sulphide ( $\text{Ce}_2\text{S}_3$ ), Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ ), Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ ) and Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ ) by Solid State Method

### 3.3. Precipitation Method

#### 3.3.1. Synthesis of undoped and doped (1%, 2% and 3% Mn, Eu,

Tb) samples of Cerium Sulphide ( $\text{Ce}_2\text{S}_3$ ), Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ ), Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ ) and Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ ) by Precipitation Method

### 3.4. Characterization Techniques

#### 3.4.1. X-Ray Diffraction (XRD)

#### 3.4.2. Energy Dispersive X-Ray Analysis (EDAX)

#### 3.4.3. Field Emission Scanning Electron Microscopy (FE-SEM)

#### 3.4.4. Photoluminescence Spectroscopy (PL)

#### 3.4.5. Thermoelectric Properties

### 3.5. Summary

### 3.6. References

## **Chapter – 4. Results and Discussion**

### 4.1. Introduction

### 4.2. X-RAY Diffraction Analysis of the synthesized samples

#### 4.2.1. X-RAY Diffraction Pattern of undoped and Mn/ Eu/ Tb

doped Cerium Sulphide Synthesized by Solid State Method

#### 4.2.2. X-RAY Diffraction Pattern of undoped and Mn/ Eu/ Tb

doped Gadolinium Sulphide Synthesized by Solid State  
Method

4.2.3. X-RAY Diffraction Pattern of undoped and Mn/ Eu/ Tb

doped Lanthanum Sulphide Synthesized by Solid State  
Method

4.2.4. X-RAY Diffraction Pattern of undoped and Mn/ Eu/ Tb

Doped Yttrium Sulphide Synthesized by Solid State Method

4.2.5. X-RAY Diffraction Pattern of Cerium Sulphide  
Synthesized by Precipitation Method

4.2.6. X-RAY Diffraction Pattern of Gadolinium Sulphide  
Synthesized by Precipitation Method

4.2.7. X-RAY Diffraction Pattern of Lanthanum Sulphide  
Synthesized by Precipitation Method

4.2.8. X-RAY Diffraction Pattern of Yttrium Sulphide  
Synthesized by Precipitation Method

4.3. Crystallite size of Synthesized samples

4.4. Morphological Analysis

4.4.1. Cerium Sulphide ( $\text{Ce}_2\text{S}_3$ ) by Solid State Method

4.4.2. Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ ) by Solid State Method

4.4.3. Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ ) by Solid State Method

4.4.4. Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ ) by Solid State Method

4.4.5. Cerium Sulphide ( $\text{Ce}_2\text{S}_3$ ) by Precipitation Method

4.4.6. Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ ) by Precipitation Method

4.4.7. Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ ) by Precipitation Method

4.4.8. Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ ) by Precipitation Method

#### 4.5. Photoluminescence Analysis (PL)

4.5.1. PL of Terbium (Tb) doped Cerium Sulphide ( $\text{Ce}_2\text{S}_3$ )

synthesized by Solid State Method

4.5.2. PL of Europium (Eu) Doped Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ )

synthesized by Solid State Method

4.5.3. PL of Terbium (Tb) Doped Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ )

synthesized by Solid State Method

4.5.4. PL of Europium (Eu) Doped Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ )

synthesized by Solid State Method

4.5.5. PL of Terbium (Tb) Doped Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ )

synthesized by Solid State Method

4.5.6. PL of Europium (Eu) Doped Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ )

synthesized by Solid State Method

4.5.7. PL of Terbium (Tb) Doped Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ )

synthesized by Solid State Method

#### 4.5.8. PL of Europium (Eu) Doped Cerium Sulphide ( $\text{Ce}_2\text{S}_3$ )

synthesized by Precipitation Method

#### 4.5.9. PL of Europium (Eu) Doped Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ )

synthesized by Precipitation Method

#### 4.5.10. PL of Terbium (Tb) Doped Gadolinium Sulphide ( $\text{Gd}_2\text{S}_3$ )

synthesized by Precipitation Method

#### 4.5.11. PL of Europium (Eu) Doped Lanthanum Sulphide ( $\text{La}_2\text{S}_3$ )

synthesized by Precipitation Method

#### 4.5.12. PL of Europium (Eu) Doped Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ )

synthesized by Precipitation Method

#### 4.5.13. PL of Terbium (Tb) Doped Yttrium Sulphide ( $\text{Y}_2\text{S}_3$ )

synthesized by Precipitation Method

#### 4.6. Comparative Study of Photoluminescence Spectra

#### 4.7. Thermoelectric Properties

#### 4.8. References

### **Chapter – 5. Conclusion and Future Scope**

#### 5.1. Conclusion

#### 5.2. Limitations

#### 5.3. Future scope

#### 5.4. References

#### List of Publications and Conference Presentations