Abstract

The thesis entitled “Rare-earth doped light emitting nano materials” consists of four chapters. Chapter one, introduction deals with a brief introduction and history of nanotechnology and light emitting nanomaterials. The phenomenon of luminescence, types of luminescence, theory of luminescence, the important physical processes which play a role in a luminescent material i.e excitation, emission, non-radiative return to the ground state and energy transfer, rare-earth ions as luminescent centers and luminescence of specific rare-earth ions. This has been followed by the survey of relevant literature published on the light emitting nanomaterials selected by the author. In the end, the applications of nanophosphors have also been included.

Chapter two, materials and methods deals with with the materials, synthesis techniques of light emitting nanomaterials and instrumentation. The list of the source compounds required for the synthesis of efficient light emitting nanomaterials is given. The various approaches for the synthesis of light emitting nanomaterials have been mentioned. Combustion and sol gel methods employed for the synthesis of nanophosphors have been described in detail. Even the various techniques and instruments used for the characterization of the light emitting nanomaterials have been discussed. These techniques are luminescence spectroscopy, tristimulus colorimetry, X-ray diffraction studies, energy dispersive X-ray analysis, IR spectroscopy, scanning electron microscopy and transmission electron microscopy.

Chapter three, red light emitting nanomaterials, deals with the synthesis, characterization and optical properties of europium doped red light emitting nanomaterials:

1. \( \text{Y}_2\text{O}_3: \text{Eu}^{3+} \)
2. \( \text{SrLa}_2\text{O}_4: \text{Eu}^{3+} \)
3. \( \text{BaLa}_2\text{O}_4: \text{Eu}^{3+} \)
4. \( \text{BaGd}_2\text{O}_4: \text{Eu}^{3+} \)
5. \( \text{Y}_{1.97}\text{Al}_{0.03}\text{O}_3: \text{Eu}^{3+} \)
6. \( \text{YCaAl}_2\text{O}_7: \text{Eu}^{3+} \)
7. \( \text{KBaPO}_4: \text{Eu}^{3+} \)
8. \( \text{KSr}_{0.4}\text{Ba}_{0.4}\text{PO}_4: \text{Eu}^{3+} \)
9. \( \text{Sr}\text{Y}_{1.7}\text{B}_{0.3}\text{O}_4: \text{Eu}^{3+} \)
10. \( \text{Ca}_3\text{Y}(\text{PO}_4)_3: \text{Eu}^{3+} \)
11. Sr$_3$Y(PO$_4$)$_3$:Eu$^{3+}$.

Chapter four, green light emitting nanomaterials, deals with the synthesis, characterization and optical properties of terbium doped green light emitting nanomaterials:

1. BaGd$_2$O$_4$:Tb$^{3+}$
2. ZrO$_2$:Tb$^{3+}$
3. BaZrO$_3$:Tb$^{3+}$
4. SrZnO$_2$:Tb$^{3+}$
5. YAlO$_3$:Tb$^{3+}$
6. CaAl$_{1.8}$Y$_{0.2}$O$_4$:Tb$^{3+}$
7. SrY$_2$O$_4$:Tb$^{3+}$
8. Sr$_3$Y(PO$_4$)$_3$:Tb$^{3+}$
9. Ca$_3$Y(PO$_4$)$_3$:Tb$^{3+}$. 