Chapter 2
Cd_{1-x}Cr_xTe single crystals with different Cr concentrations (0 \leq x \leq 0.5) were grown from pure CdTe and CrTe by modified vapour phase growth technique. The optimum growth conditions for growing the Cr doped CdTe crystals were arrived through trial and error method. The grown bulk crystals were subjected to structural, morphological, optical, dielectric and magnetic characterizations.

1. XRD studies confirmed that all the Cr doped CdTe crystals of all compositions were in cubic structure.
2. Morphological studies showed smooth surfaces without any voids and pits. SAED pattern studies confirmed that the grown Cd_{1-x}Cr_xTe crystals are single crystalline in nature.
3. Reflectance studies showed a shift in fundamental absorption edge towards lower energy with increase in Cr composition. The band gap of Cd_{1-x}Cr_xTe crystals varied linearly with Cr in the present study.
4. Magnetic studies showed complete ferromagnetic behavior for the Cd_{1-x}Cr_xTe crystals. The observed ferromagnetism was due to super exchange interaction between localized ‘d’ spins of the Cr^{2+} and the free localized ‘d’ carriers.
5. The Dielectric constant (\varepsilon') and dielectric loss (tan \delta) decreased with the frequency of external electric field and increases with the increase of temperature.

Chapter 3
Co doped CdTe powders with Co concentrations of 5 at.% and 8 at.% were synthesized by single step solid state reaction. Appropriate quantities of freshly prepared CoTe and CdTe were mixed and ground thoroughly for 16 - 18 hours to ensure homogeneity and then sintered at 500 °C for 6 hours under a pressure of 10^{-3} mbar. The sintered Co doped CdTe powders were subjected for structural, elemental, optical, dielectric and magnetic characterizations.
1. XRD pattern showed cubic structure for all compositions of Co doped CdTe powder samples.
2. The EDAX spectra revealed presence of Cd, Te, and Co and their weight (wt.%) ratios and atomic (at.%) ratios.
3. Reflectance studies showed a shift in fundamental absorption edge towards lower energy with increase in Cr. The band gap of Co doped CdTe powders increased linearly with Cr composition in the present study.
4. All the Co doped CdTe powders exhibited a well-defined magnetization hysteresis confirming ferromagnetic behaviour at room temperature.
5. The Dielectric constant ($\varepsilon'$) and dielectric loss (tan $\delta$) decreased with the frequency of external electric field and increases with the increase of temperature.

Chapter 4
Nanocrystalline CdTe thin films were prepared by electron beam evaporation technique at different substrate temperatures. The prepared thin films were characterized for structural, morphological and optical properties.
1. XRD patterns confirmed the poly crystalline nature of the films with cubic structure of the CdTe thin films.
2. HRSEM images showed uniform film surface and increased crystallite size with substrate temperature. EDAX spectra revealed peaks corresponding to Cd and Te with nearly stoichiometric.
3. Optical transmittance spectra showed that the absorption edge of the films moved towards the higher wavelengths with increase in substrate temperature. The optical band gap of the CdTe films decreased with increase of substrate temperature from 423 K - 673 K.

Chapter 5
Pure and Cr diffused CdTe thin films with different Cr content were prepared using electron beam evaporation onto a glass substrates at a substrate temperature of 373 K followed by annealing at 573 K. The prepared thin films were characterized for structural, morphological and optical properties.
1. Structural studies showed a predominant (1 1 1) reflection corresponding to the cubic structure of CdTe.

2. The cross-sectional HRSEM images showed the growth pattern in the film. EDAX spectra revealed the presence of Cr, Cd and Te with nearly stoichiometry.

3. Magnetic measurements showed an improved magnetic moment in sample S3. Increase of Cr thickness in sample S4 resulted a decrease in magnetic moment.

4. Raman spectra showed peaks located at about 119 cm\(^{-1}\), 139 cm\(^{-1}\) and 156 cm\(^{-1}\) which corresponds to A1, TO and LO active modes of CdTe.

Chapter 6
The Co diffused CdTe thin films were prepared by electron beam evaporation technique onto glass substrates at a substrate temperature of 373 K followed by annealing at 573 K. The prepared thin films were characterized for structural, morphological and optical properties.

1. XRD pattern confirmed cubic structure for all the Co diffused CdTe thin films.
2. SEM image showed smooth and uniform film surface.
3. Raman spectra showed three major peaks located at about 120 cm\(^{-1}\), 140 cm\(^{-1}\) and 160 cm\(^{-1}\) corresponding to A1, LO and TO raman active modes of CdTe respectively.
4. Magnetic measurements exhibited a clear hysteresis curve for all the Co-diffused CdTe thin films. Increase of Co thickness resulted an increase in magnetization.

Conclusions

- Cd\(_{1-x}\)Cr\(_x\)Te single crystals were grown successfully using Vapour phase growth method. The optimum growth conditions for growing the Cd\(_{1-x}\)Cr\(_x\)Te crystals were arrived through trial and error method.

- Cd\(_{1-x}\)Co\(_x\)Te powders were synthesized by single step solid state reaction. Optimum firing temperatures were arrived at 500 °C for 6 hrs under a pressure of 10\(^{-3}\) mbar after a great deal of trial and error procedure.
- Pure CdTe, Cr diffused CdTe and Co diffused CdTe thin films were prepared by electron beam evaporation technique onto a glass substrates.

- XRD studies revealed cubic structure of Cd$_{1-x}$Cr$_x$Te crystals, Cd$_{1-x}$Co$_x$Te powders, Pure CdTe, Cr diffused CdTe and Co diffused CdTe thin films.

- The as-grown Cd$_{1-x}$Cr$_x$Te crystals, Cd$_{1-x}$Co$_x$Te powders, Pure CdTe, Cr diffused CdTe and Co diffused CdTe thin films were subjected to chemical analysis and the average composition was in agreement within the target compositions.

- The surface morphology studies of the Cd$_{1-x}$Cr$_x$Te crystals revealed screw dislocations aided growth. Uniform film surface was observed for pure CdTe thin films, growth pattern in the film was observed for Cr and Co diffused CdTe thin films.

- Reflectivity studies of Cd$_{1-x}$Cr$_x$Te crystals and Cd$_{1-x}$Co$_x$Te powders showed a shift towards lower energies in the fundamental absorption edge ($E_0$) with composition ($x$). Transmittance studies of pure CdTe thin films also showed a shift towards lower energies in the fundamental absorption edge with increase in substrate temperature.

- The magnetic studies on Cd$_{1-x}$Cr$_x$Te samples, Cd$_{1-x}$Co$_x$Te powders, Cr diffused CdTe and Co diffused CdTe thin films revealed ferromagnetic behavior at room temperature.

- The Dielectric constant ($\varepsilon'$) and dielectric loss (tan$\delta$) decreased with the frequency of external electric field and increases with the increase of temperature for Cd$_{1-x}$Cr$_x$Te samples, Cd$_{1-x}$Co$_x$Te powders.

- Raman spectra showed peaks correspond to A1, TO and LO active modes of CdTe in both Cr diffused CdTe and Co diffused CdTe thin films.