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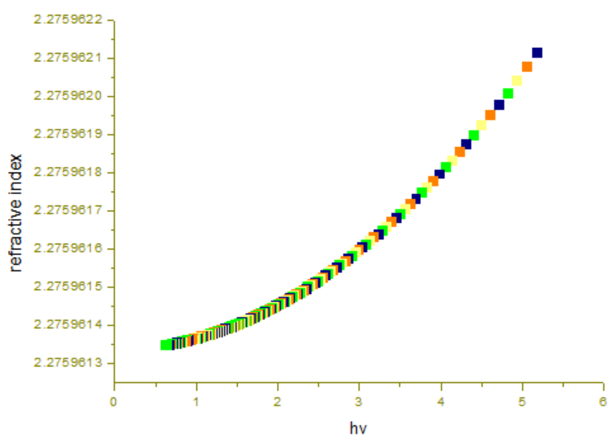

(b)

Figure 8: Variation **of** Refractive index **(n)** with (a) wavelength and (b) photon energy of $Fe_2Mn_2Ni_2Zn_2O_{11}$

The dispersion energy of the sample is calculated using the Wemple-DiDomenico (WD) model. Results are plotted graphically in (Fig.8). Refractive index of the sample annealed at different temperatures can be calculated using Sellmeir dispersion formula [23].

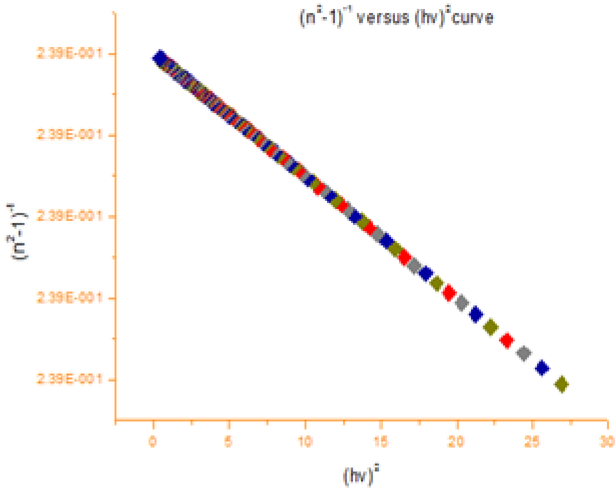

Figure 9: $(n^2-1)^{-1}$ versus(hv)^2 curve

Plotting of $(n^2-1)^{-1}$ against (h v)^2 allows to determine, the oscillator parameters, by fitting a linear function to the smaller energy data, E_o and E_d can be determined from the intercept, (E_o/E_d) and the slope $(1/E_oE_d)$. E_o is considered as an average energy gap to, it varies in proportion to the Tauc gap $E_o \sim 2E_g$. The data of the dispersion of the refractive index (n) were evaluated according to the single oscillator model proposed by wimple and DiDomenico as, $n^2 = 1 + (E_dE_0)/(E_0^2\text{-}hv^2)$---- (7). Where E_o is the oscillator energy and E_d is the oscillator strength or dispersion energy.

The curves of $(n^2 - 1)^{-1}$ against $(1/\lambda^2)$ (Fig.10) are fitted into straight lines following the sell Meier's dispersion formula. The value of S_o and (λ_o) are estimated from the slope (1/So) and the infinite wavelength intercept $(1/S_0\ \lambda_o)^2$. The optical parameters of the sample were calculated and listed in the table.2 given below. The oscillator model can be also written as $n^2\text{-}1=S_0\ \lambda_0^2\ /[1\text{-}(\ \lambda o\ /\ \lambda)^2\ ]$--- (8) where λ is the wavelength of the incident radiation, S_o is the average oscillator strength and λ_o is an average oscillator wavelength.

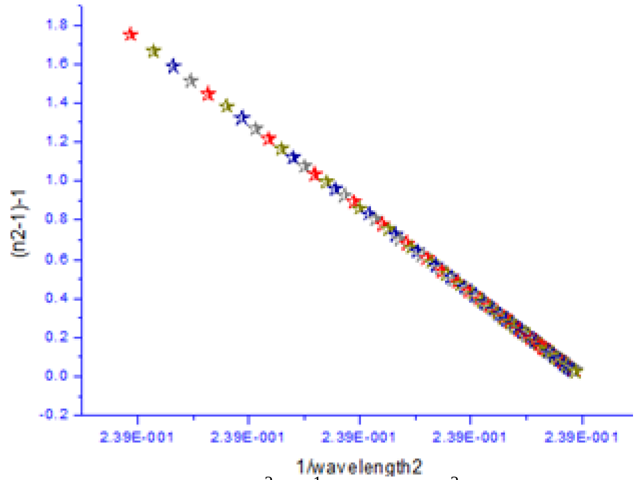

Figure 10: $(n^2\text{-}1)\text{-}^1$ versus $1/\lambda^2$ curve

Table 2: The calculated values of the optical parameters of $Fe_2Mn_2Ni_2Zn_2O_{11}$

Sample	E_g(eV)	E_O(eV)
At 30^0	1.28	2.56
At 500^0	2.34	4.68
At 800^0	1.71	3.42
At 950^0	2.24	4.48

From the above table it is clear that as the temperature is increased, band gap energyE_g and the oscillator energy E_0 also increases. The dispersion energy also shows a decline as the temperature rises and the sample attains its perosvkite phase. Further the mechano chemical process has an advantage due to low-costs and widely available materials, leading to a simplified process.The curves with straight line graphs confirms the sell Meier's dispersion formula.

4. Conclusion

The increase in the band gap energy increases the dielectric properties of the material.The UV emission peak shifts significantly to higher wavelengths with increasing annealing temperatures. It is confirmed that tunable band gaps are obtained by varying annealing temperatures. Band gap energy and the optical properties of the nano ceramic material $Fe_2Mn_2Ni_2Zn_2O_{11}$ can be used for UV_VIS shielding applications. According to Wemple- DiDomenico single-oscillator model the dispersion energy decreases as the sample attains its perosvkite phase. At high temperature the band gap energy increases and becomes more dielectric. For new generation capacitors nano crystalline ceramics $Fe_2Mn_2Ni_2Zn_2O_{11}$ materials will prove as a future substitute. Optical measurements confirmed that absorbance and reflectance increases with temperature.

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