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Successor of CMOS Technology by Heterogeneous Material - Hydroxyisoquinolin-hydrogen succinate

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Abstract - *CMOS technologies have been forecasted for several years, advances in fabrication made it possible to reach limits beyond our prediction, such a novel research bawl, might be a successor of CMOS technology. Wildly heterogeneous systems that enable hardware and software, from system software down to hardware mechanisms. Abstractions of novel compound Hydroxyisoquinolin-hydrogen succinate made technologies viable for flash storage.*

Key Words: **CMOS technology, Flash storage, self-de-focusing, firmware, multiphoton, Non-linear**.

1. Experiment

1-Hydroxyisoquinolin-2-ium succinate was synthesized using the raw materials 1-hydroxyisoquinoline (1.45 g) and succinic acid (1.18 g) in an equimolar ratio. These reactants were dissolved in 10 ml of ethanol solvent and yellow precipitate was obtained after some time. The precipitate was dissolved in the same solvent and it is kept at room temperature for crystallization. After a span of four days, rod like crystals for diffraction study were harvested.

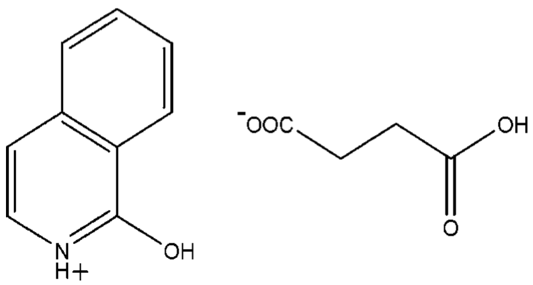

Fig-1: Structure of 1-Hy-dr-oxy-isoquinolin-2-ium hydrogen succinate

2. Results and Discussion:

UV-Vis spectral studies reveal the grown crystals are transparent in the wavelength region 400 – 900 nm. The thermal characteristics were analyzed by TGA/DTA studies. The dielectric and mechanical behavior of Hydroxyisoquinolin-hydrogen succinate crystal were investigated.

UV-Vis transmission spectrum of 8Hydroxyisoquinolin-hydrogen succinate crystal was recorded using a T90+ PG Instruments spectrophotometer. The lower cut-off wavelength of crystal was found to be 412 nm and the absorption was due to the promotion of an electron from a 'non-bonding' (lone-pair) n-orbital to an 'anti-bonding' π-orbital designated as π* (n → π*) and no characteristic absorption was observed in the entire visible region (Fig.2). The dependence of optical absorption coefficient with the photon energy helps to study the band structure and the type of transition of the electron. The absorption coefficient (α) can be determined from the transmission (T) spectrum based on the following relation,

$$\alpha = \frac{2.3026}{t}\log(1/T)$$

In the high photon energy region, the energy dependence of absorption coefficient suggests the occurrence of direct band gap of the crystal obeying the following equation for high photon energies (hν)

$$(\alpha h\nu)^2 = A(E_g - h\nu)$$

where E g is the optical band gap of the crystal and A is a constant. The band gap of the crystal was evaluated by plotting (αhν) 2 versus hν as shown in Fig.2 and found to be 2.94 eV.

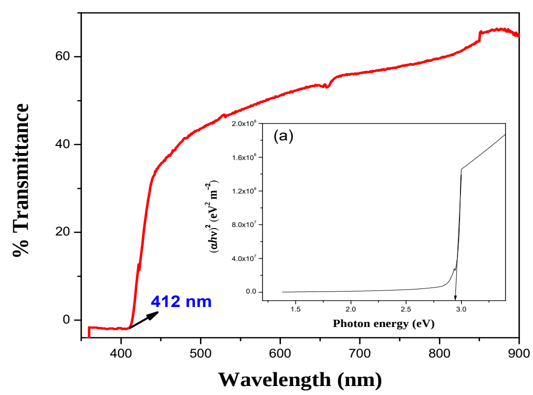

Fig-2: UV-Vis transmission spectrum and plot of (αhν)2 vs. hν (inset) for crystal

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Thermogravimetric (TG) and differential thermal (DT) analyses were carried out in a nitrogen atmosphere using a SDT–Q600 TA instrument with a heating rate of 10 °C / min. The DT curve indicates the same changes as shown in TG curve (Fig.3). From the TG curve, it is observed that the material is stable up to 130 °C and moisture free. The TG curve shows two stages of weight loss pattern when the material was heated from 30 to 400 °C. The first weight loss pattern starts from 131 to 161 °C with the elimination of 4.5 % of the material into gaseous products as seen in the low temperature region. The second stage of weight loss occurring between the temperatures 162 and 235 °C experiences a weight loss about 89 %. Thus, the crystal could be exploited for any applications below 130 °C.

He-Ne laser with 632.8 nm radiation was used for Z-scan study. Figure-3 (a) & (b) show the Z-scan curves for the open and closed aperture modes of single crystal. Generally, typical Z-scan data with fully open aperture is insensitive to nonlinear refraction. Therefore, the data are expected to be symmetric with respect to focus. For materials with multi-photon absorption, there is a minimum transmittance in focus (valley) and for saturable absorber samples there is a maximum transmittance in the focus (peak). The saturation of absorption enhances the peak and suppresses the valley, while saturation produces the opposite effect. The peak followed by a valley transmittance is the signature of negative nonlinearity. This is known as self-defocusing effect which is due to local variation of refractive index with temperature. The experimental observation shows the occurrence of multiphoton absorption in the single crystal.

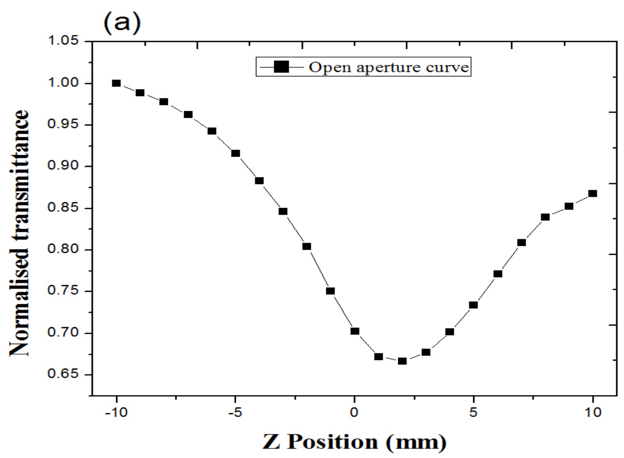

Fig-3(a): Open aperture of Z-scan curves

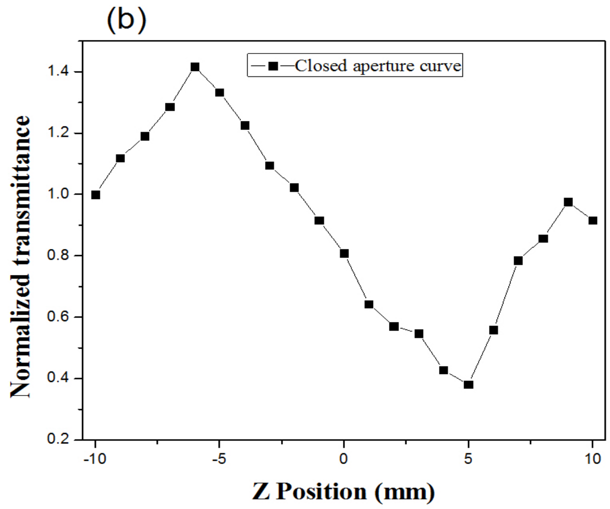

Fig-3(a): Closed aperture of Z-scan curves

The measurable quantity ΔT_{p-v}, the difference between the peak and valley transmittances, $(T_p - T_v)$ as function of $|\Delta\varphi_0|$ $|\Delta\varphi_0|$ is given by

$$|\Delta\varphi_0| = \frac{\Delta T_{p-v}}{0.406(1-S)^{0.25}}$$

where S is the aperture linear transmittance and $\Delta\varphi_0$ is the on-axis phase shift.

$$S = 1 - \exp\left(\frac{-2r_0^2}{\omega_0^2}\right)$$

The on-axis phase shift is related to the third order nonlinear refractive index,

$$n_2 = \frac{\Delta\varphi_0\lambda}{2\pi I_0 L_{eff}}$$

$$L_{eff} = \left[\frac{1-\exp(-\alpha L)}{\alpha}\right]$$

Where L_{eff} is the effective thickness of the sample, α is the linear absorption coefficient, L is the thickness of the sample, I_0 is the on-axis irradiance at focus and n_2 is the nonlinear refractive index. From open aperture Z-scan data, the nonlinear absorption coefficient β is estimated.

$$\beta = \frac{2\sqrt{2}\Delta T}{I_0 L_{eff}}$$

The real and imaginary parts of the third order nonlinear optical susceptibility ($\chi^{(3)}$) are determined from experimental determination of n_2 and β according to the following relations,

$$\mathrm{Re}\,\chi^{(3)}(\mathrm{esu}) = 10^{-4}\,\frac{\varepsilon_0 C^2 n_0^2\, n_2}{\pi}\left(\frac{\mathrm{cm}^2}{\mathrm{W}}\right)$$

$$\mathrm{Im}\,\chi^{(3)}(\mathrm{esu}) = 10^{-2}\,\frac{\varepsilon_0 C^2 n_0^2\, n_2\, \lambda\beta}{4\pi^2}\left(\frac{\mathrm{cm}}{\mathrm{W}}\right)$$

The absolute value of $\chi^{(3)}$ was calculated from the following relation,

$$\mathrm{Re}\,\chi^{(3)}(\mathrm{esu}) = 10^{-4}\,\frac{\varepsilon_0 C^2 n_0^2\, n_2}{\pi}\left(\frac{\mathrm{cm}^2}{\mathrm{W}}\right)$$

$$\left|\chi^{(3)}\right| = \left[\left(\mathrm{Re}\left(\chi^{(3)}\right)\right)^2 + \left(\mathrm{Im}\left(\chi^{(3)}\right)\right)^2\right]^{\frac{1}{2}}$$

The estimated nonlinear refractive index (n_2), absorption coefficient (β) and third order susceptibility ($\chi^{(3)}$) values of 2CPN crystal are 3.14×10^{-7} cm²/W, 1.91×10^{-3} cm/W and 1.56×10^{-5} esu, respectively. The nonlinear absorption is attributed to a multiphoton absorption process and the nonlinear refraction leads to the self-defocusing nature in the crystal.

3. Conclusions

As our studies clearly structured four partially overlapping areas, videlicet: (a) far-fetched materials and physics such as spin, Nano magnets, phase transition, and correlation, (b) future materials such as nanowires, neuromorphic devices and nanotubes, (c) lower software layers such as runtime support, middleware, and designed firmware as in Macintosh, and (d) upper software layers like programming, languages and framing software.

REFERENCES

[1] S. Ambalatharasu, A. Sankar, G. Peramaiyan, G. Chakkaravarthi, R. Kanagadurai. Structure reports of 8-Hydroxyquinolinium Succinate, Acta Cryst. Vol. E70 (2014), o49.

[2] Sankar A, Ambalatharasu S, Peramaiyan G, Chakkaravarthi G and Kanagadurai R, Acta Cryst. E70 (2014) o 450-o451.

[3] Kaino T, Kurihara T, Kubodera K, and Kanbara H, Third-Order Nonlinear Optical Properties of Organic Materials, ACS Symposium Series; American Chemical Society: Washington, DC, 1991.

[4] Tauc J, Grigorovici R, Vancu A. Phys. Status Solidi B 15 (1966) 627-637.

[5] Marder SR, Torruellas WE, Desce MB, Ricci V, Stegeman GI, Gilmour S, Bredas JL, Li J, Bublitz GU, Science 276 (1997) 1233-1236.