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STUDY OF OPTICAL AND MECHANICAL PROPERTIES OF LASER DYES DOPED-POLYMERS, BCC METALS AND LAYERED SUPERCONDUCTORS

Gunjan Bansal

Research Scholar, Calorx Teachers' University, Ahmedabad, Gujarat

INTRODUCTION

Scientists today think that optical computing will someday be common, but most agree that transitions will occur in specialized areas one at a time. Most of the optical integrated circuits have been designed and manufactured by using optical circuits. The optical devices are controlled by electronic currents, though the impulses carrying the data are visible light or infrared. An optical/photonic computer is a device that uses the photons in visible light or infrared beams, rather than electric current, to perform digital computations. An electric current creates heat in computer systems. The more electricity is required for fast processing and therefore all this extra heat damages the hardware. Light, however, doesn't create significant amount of heat. By applying some of the advantages of visible and/or infrared networks at the device and component scale, a computer might someday be developed that can work 10 or more times faster than a conventional electronic computer.

Optical technology has made most significant inroads for the development of such a photonic computer. The ultimate goal is so-called the photonic network , which uses visible and infrared energy exclusively between each source and destination. Optical technology is employed in CD-ROM drives and their relatives, laser printers, photocopiers and scanners. However, none of these devices are fully optical; all rely to some extent on conventional electronic circuits and components.

Optical switches, optical bistable devices and spatial light modulators are important key elements in optical computers and optical data processing systems. However the lack of appropriate materials has been considered as a bottleneck in realizing the potential of the field. During the last two decades, most experiments on organic non linear materials have concentrated on optical modulation, optical bistability, optical phase conjugation and related phenomena.

An all-optical device based on organic materials operates on the intensity-induced changes in the complex index of refraction, that is, the absorptive and dispersive properties of the medium due to population change. During the present work, the phenomenon of optical bistability has been studied in organic chromophores that will help to develop bistable optical

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devices.

There has been a great interest in optical bistable devices using a saturable absorber for use in an optical cavity. The phenomenon of optical bistability was first reported by Gibbs et al in 1976. In such devices certain parameters of a non-linear system have two stable states and are therefore useful for applications such as optical logic, optical switch and optical memory. In case of an intra-cavity saturable absorber, absorption characteristics are different depending upon whether the incident pump power is increasing or decreasing. Other types of materials depend on thermally induced changes in resonator optics where the absorption coefficient or the index of refraction is temperature dependent. Also earlier devices have required resonant optical cavities but no such cavity is required for the devices based on optical bistability and therefore eliminating the resonant cavity removes restrictions on tuning the light frequency and offers the potential for broad-bandwidth operation.

Linear or Conventional optics is the basis of all photonic applications. In linear interactions of light with matter such as diffraction, refraction, absorption and birefringence produced with the light of sufficiently small intensities. For these phenomena, applied incident intensity is not important and not even measured but for non-linear case the characteristic effects are dependent on intensity of applied light. Typically more than 10^{18} photons cm^{-2} s^{-1} are needed to reach nonlinearity in materials with fast reaction times that can be provided by lasers. The material parameters characterizing the nonlinear optical behavior such as cross-section, nonlinear refractive indices and decay times are determined as a function of light and sample parameters.

FLUORESCENCE QUENCHING OF EOSIN IN PRESENCE OF ACETONE

Eosin is a fluorescent red dye designated by the formula $C_{20}H_8O_5Br_4$ resulting from the action of bromine on fluorescein. There are actually two very closely related compounds commonly referred to as Eosin. Most often used is Eosin Y that has very slightly yellowish cast. The other Eosin compound is Eosin B which has a very faint bluish cast. The two dyes are interchangeable, and the use of one or the other is a matter of preference; Eosin Y is a tetrabromo derivate of fluorescein and Eosin B is a dibromo dinitro derivate of fluorescein. In Present case of studies the Eosin Y dye (Figure 2.1) is used because of its structural stability against the environmental change mainly due to temperature, solvent and concentration.

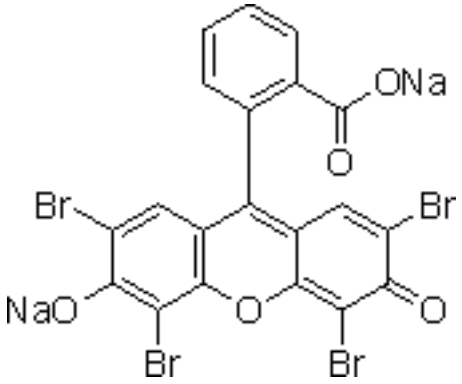


Figure 2.1 Structure of Eosin Y

Eosin dyes are extensively used in various purposes in the laboratories. It is being used as a photosentisizer for various applications. Suri et al used it to produce Eosin based solar cells. Eosin Y is a molecular organic dye interesting for the photovoltaic conversion in association with the nanoporous semiconductors, like ZnO. Such molecule does not only show interesting properties itself, but also play a relevant role in determining the global features of hybrid nanostructured materials. Hematoxylin and Eosin stained paraffin section have also been examined by fluorescence microscopy to study the pattern and distribution of fluorescence. It is also used in textile dyeing and ink manufacturing, the red sodium salt of this powder is used in biology to stain cells. Further, Eosin is an orange-pink dye used to stain cytoplasm, collagen and muscle fibers for examination under the microscope. Hematoxylin however is a basic dye and shows up in the acidic part of the cell.

Acetone is a commercially used solvent of great importance as it has got a wide application in biomedical and chemical reactions. Animals which are being exposed to acetone in air also has long irritation and become unconscious and even some of them dies. Therefore, there is a need to control the amount of acetone in the environment, it is possible only when the exact amount of the acetone present is calculated. Fluoresence quenching is one of the techniques that can be used to detect the quantity of the chemicals in the environment. The quenching procedure is particularly useful for biological macromolecules. This is because it permits the relaxation rates to be measured without verification of the temperature. The present communication discusses the important aspect of flouresence quenching of Eosin Y in presence of acetone that may lead to design the acetone sensor.

FLUORESCENCE CHARACTERISTICS OF COUMARIN DERIVATIVES WITH DIVALENT METAL IONS

Nickel is one of the essential elements in the organism and can strengthen the secretion of the insulin, lower the blood sugar level, stimulate the hemutopoiesis function, promote the regeneration of the red corpuscles, and treat the anemia and cirrhosis. It has buffer action to lung worry, asthma and heart–lungs function in disfigurement. Though it has such important function on people, the amount of nickel needed is very little in human metabolism.

However, the source of nickel is very extensive in the surrounding environment, and the phenomenon of lacking nickel is very seldom. On the contrary, excessive nickel can cause nose cancer, lung cancer and leukemia in the rich nickel environment. In addition, it can also produce the diseases such as heart attack, apoplexy, chronic hepatitis, uremia and gall stone, etc. Therefore, people pay more and more attention to their own health with the improvement of the living standard, and the question about the pollution of nickel has also been paid close attention. Therefore, the importance of the determination of nickel in environmental samples can hardly be overemphasized because they have undoubtedly a serious potential hazard to the human organism. The main sources of nickel in aquatic systems are from dissolution of rocks and soils, biological cycles, atmospheric fallout, and especially industrial processes and water disposal.

Cobalt has both beneficial and harmful effects on humans. It is part of vitamin B-12 and is used in the treatment of anaemia. The harmful effects of cobalt are respiratory irritation, coughing, asthma, pulmonary oedema, and pneumonia. The International Agency for Research on Cancer classifies cobalt as a 'possible human carcinogen'. Exposure to cobalt salts may cause skin problems, and may damage the kidneys and cause lung damage. Cobalt can damage the heart, causing heart failure. Repeated exposures can cause scarring of the lungs (pulmonary fibrosis) which may not be noticed without a chest x-ray. This can be disabling or fatal.

Tin is used for cane coating: tin-plated steel containers are widely used for food preservation. Tin alloys are employed in many ways: as solder for joining pipes or electric circuits, pewter, bell metal, babbit metal and dental amalgams. The niobium-tin alloy is used for superconducting magnets, tin oxide is used for ceramics and in gas sensors as it absorbs a gas its electrical conductivity increases that can be monitored. Tin foil has been a common wrapping material for foods and drugs, now replaced by the use of aluminum foil. The organic tin bonds are the most dangerous forms of tin for humans. The number of applications of organic tin substances is still increasing, despite the fact that the consequences of tin poisoning are known. The effects of organic tin substances can vary. Triethyltin is the most dangerous organic tin substance for humans. It has relatively short hydrogen bonds. When hydrogen bonds grow longer a tin substance will be less dangerous to human health. Humans can absorb tin bonds through food, breathing and through the skin. Acute effects are: Eye and skin irritations, headaches, stomachaches, sickness, dizziness, severe sweating, breathlessness, rination problems and long-

term effects are: depressions, liver damage, malfunctioning of immune systems, chromosomal damage, shortage of red blood cells and brain damage (causing anger, sleeping disorders, forgetfulness and headaches).

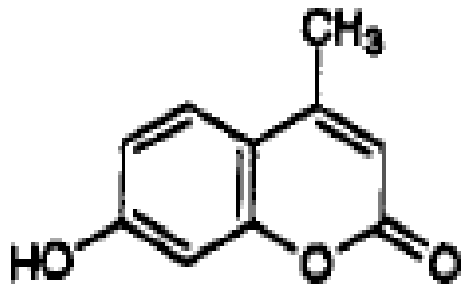


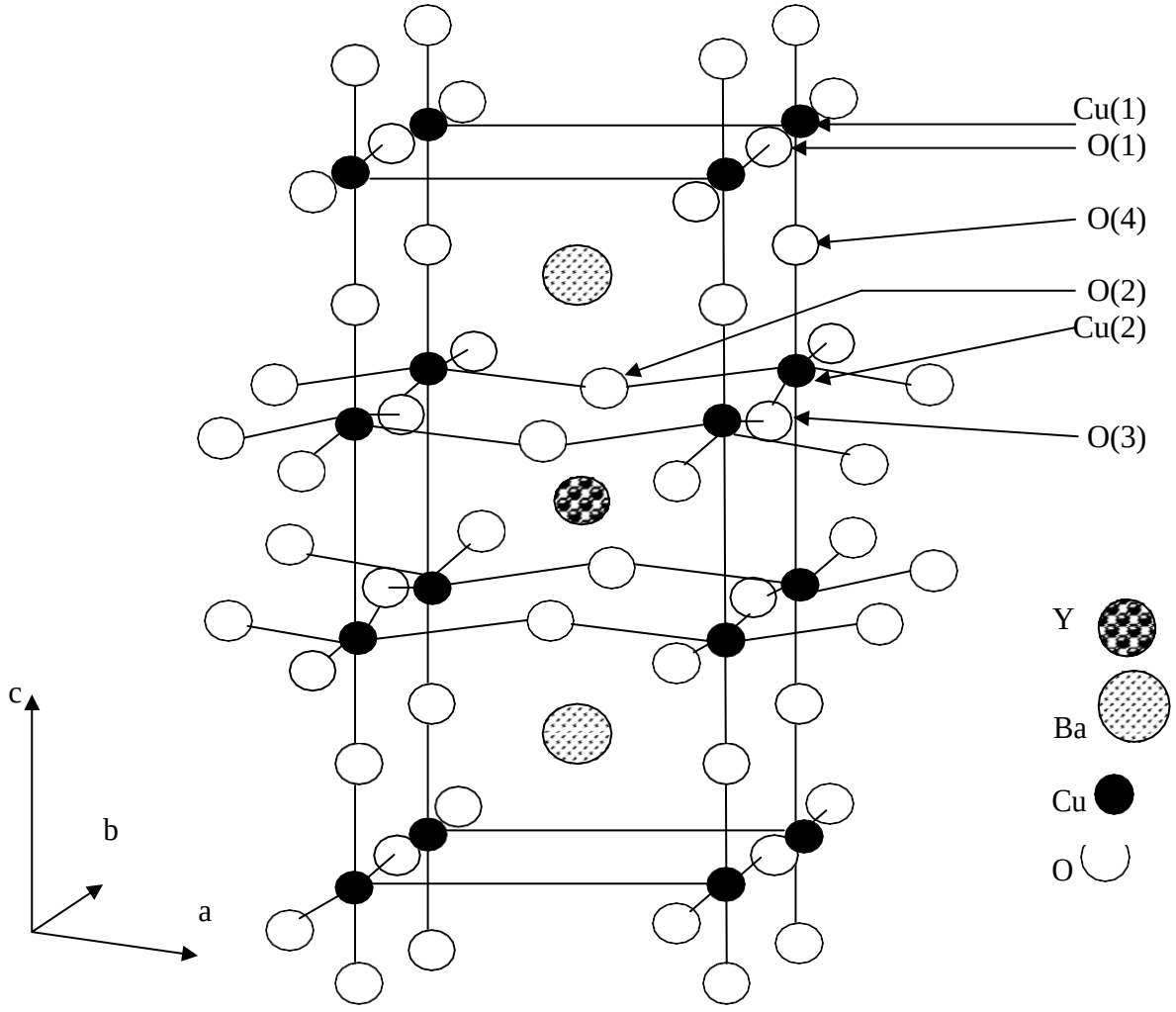
Fig 1. Molecular Structure of Coumarin-4

IRON DOPED LAYER YBCO SUPERCONDUCTOR

Layered superconductors are well known for exhibiting superconductivity and many layered superconductors are known till date. Most of these are cuprates which are common one and also very important for the phenomena of superconductivity. High temperature superconductivity in cuprates is dramatically different from conventional superconductors. These materials are comprised of one or more crystal planes per unit cell consisting of only Cu and O atoms in a square lattice as shown in Figure 4. Superconductivity originates among the strongly interacting electrons in these CuO_2 planes. Crystal structure of YBCO is either orthorhombic or tetragonal depending upon oxygen deficiencies and ordering of oxygen over the two available sites on a and b axis. Two distinct sites for copper: one site labeled Cu (I) between two barium planes and forms one dimensional Cu(I)-O(I) chains in the orthorhombic phase, the other site Cu(2) situated between the Y and Ba planes that form two dimensional Cu(2)-O(2,3) planes. The effect of adding impurities to the YBCO crystal is one of the important area of interest for the scientists working in superconductors and their properties. Impurities have drastic effect on the properties of the superconductors. Pinglin Li et al in 2004 investigated the structural and superconducting properties of YBCO by introducing the Al and Zn in replacement to Cu atoms in the crystal and they found increase in the superconductivity of the material. In 2005, Liu et al introduced iron atom in the YBCO material and observed that the high-pressure synthesis makes only a slight amount of Fe located at Cu(2) sites migrate to Cu(1) sites and there is no obvious magnetic pair-breaking effect induced by Fe located at Cu(2) sites.

In order to discover the effects of oxygen ordering and carrier concentration on YBCO superconductivity, Zn- and Fe-doped systems were investigated as a function of dopant concentration and of oxygen stoichiometry, and with respect to resistive characteristics, bulk

symmetry and oxygen micro-domain ordering by Licci et al in 1995. They have further reported that the pair-breaking imputable to Zn substitution is found to be very effective on superconducting temperature. In another work reported by Matsunami et al, it was found that with the addition of Mg impurities in YBaCuO (YBCO) films on MgO substrate, the critical temperature T_c decreases by 10 K for inclusion of 5% Mg in YBCO. Recently, Mohanta et al (2009) have studied effect of inclusion of Ga and Zn doping in YBCO material.



Structure of $YBa_2Cu_3O_{7-\delta}$

Figure 4 Structure of YBCO. For YBCFO few Copper sites are replaced by Iron atoms

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