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An Examination Of The Manufacturing And ElectricalProperties Of Heterobimetallic Compounds Based On Chalcones For Dithioligands

Ashutosh Dixit Department of Electrical Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002
ashutoshdixit@geu.ac.in

Parvesh Saini Department of Electrical Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002
parvesh.saini.eee@geu.ac.in

Manish Kumar Lila Department of Mechanical Engineering, Graphic Era Hill University, Dehradun, Uttarakhand India, 248002
mlila@gehu.ac.in

Abstract

The semi-conducting electronic material industry is in need of new semiconducting materials with suitable band gap ranges. It has been reported that a number of dithio compounds have good semiconducting characteristics. In the current study, heterobimetallic complexes with variable temperature solid-state electrical conductivity are synthesised, characterised, and studied. [M= Cu(II), Zn(II), and M′= Fe(II), Ni(II), and Co(II). Elemental analysis, FT-IR, 1H & 13C-NMR, UV-Visible, powder XRD, and solid- state electrical conductivity have all been used to describe these compounds. The electrical conductivity of these compounds ranges from rt = 2.1 10-5 to 8.8 105 (Scm-1)

Keywords: Heterobimetallic, Chalcone, Semiconductor, dithio complexes, Electrical conductivity

1. Introduction

The non-linear optical properties of chalcones such as excellent blue light transmittance and crystallization ability have been reported. A Conjugated system with hetero atoms is the interest of chemists for the synthesis of metal-based semiconducting molecular material. Several works have been reported with complex related monometallic complexes having the band in the range of good semiconductors [1]. We report here some new chalcones based mono, bimetallic complexes where [M= Cu(II), Zn(II) and M′= Fe(II), Ni(II), Co(II), CS32- = tri-thiocarbonate, L = chalcone based ligand. There structure aspects and electrical behavior were analyzed. In a state of nonpolar molecules discovered many compounds like Ferrocene in a staggered arrangment, but their eclipsed

(D5h) and twisted (D5) forms are capable of SHG. Computed moments included molecule polarizabilities [2]

2. METHODS

2.1 Preparation of Chalcone based ligand (L) :

In 25 ml of ethanol, 0.1 mol of benzaldehyde and 0.1 mol of 2-acetyl-1-naphthol were added and agitated at room temperature for an hour. Then, added 1.5 ml of a 40% KOH solution, and the solution was left at normal temperature for the remainder of the day. The reaction mixture was then added to a bowl of ice-cold, diluted HCl-containing water [4]. The resulting solid product was separated by filtering, recrystallized in ethanol, and then stored above CaCl2.

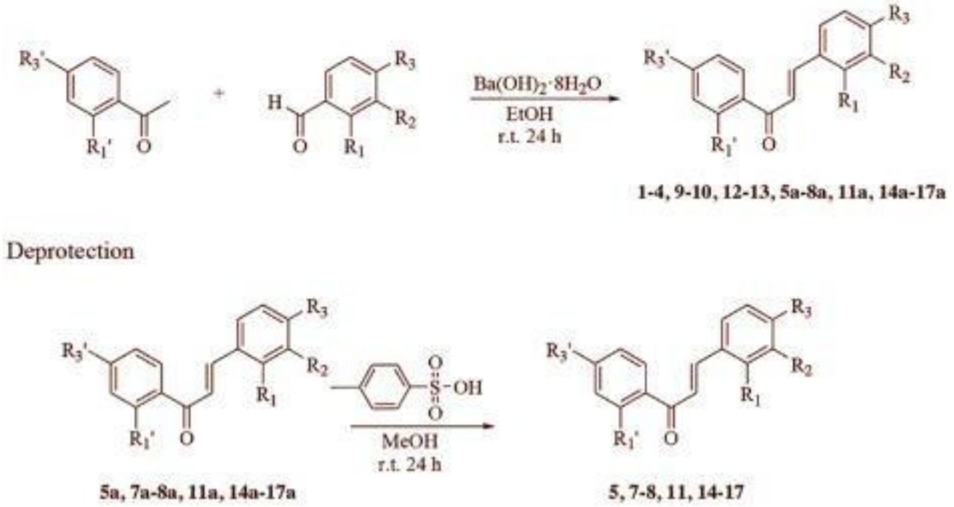


Figure. 1. Preparation of chalcone based ligand (Claisen- Schmidt condensation)

2.2 Preparation of tri-thiocarbonate ligand:

The carbon disulfide (CS2) solution in DMF was mixed with an aqueous solution of potassium hydroxide (KOH) at a temperature of 15-20 0C to create the potassium salt of K2CS3.

2.3 Preparation of complexes

The chalcone ligand was complexed with metal salt (Ferrous sulfate/Cobalt Chloride/Nickel Chloride) by usual methods. The metal salts solutions in ethanol-water (1:1, V/V) was slowlyadded with stirring to the solution of ethanolic chalcone ligand solution, to get the metal chalcone complex.To modify the donor/acceptor interface in a

GQD film was created for a photovoltaic (PV) device using a sonication treatment in solution. This method simplifies the traditional techniques, such as laser fragmentation and hydrothermal treatment, which restrict the number of component layers and require low-cost processing [5].The salts were made by slowly adding a saturated copper sulfate/zinc acetate ethanolic-water solution to a solution of a tri-thiocarbonate ligand. The prepared solution was filtered into the metal-chalcone complex solution and agitated there for four to five hours at room temperature. The end results were filtered out and vacuum-dried on CaCl2.Chalcones are organic substances that occur naturally and have a variety of biological properties connected to their structure [6]. This study used mass spectrometric methods to look at the interactions between chalcones, specifically 2′,4′-dihydroxy-2-methoxychalcone and 2′,4′-dihydroxy-3-methoxychalcone, and organofunctionalized Fe3O4 magnetic nanoparticles. The silanization of Fe3O4 particles with 3-aminopropyltrimethosysilane produced the magnetic nanoparticles, which were then treated with 3-hydroxybenzaldehyde or 2-pyridinecarboxaldehyde to produce Schiff base derivatives [7].

3. Analysis and Physical Measurements

C, H, and N elements were examined using a Carlo Erba 1108 component analyzer. Standard gravimetric methods were used to measure the metal and sulphur, and conc. HNO3 was used to dissolve the complex's organic components. An open capillary was used to measure the melting point without any corrections. TLC on silica gel plates was used to monitor reaction progress and purity [3]. The 1H and 13C-NMR spectra were recorded using 700 MHz modelswith DMSO-d6 as the dissolvable, and the UV-Visible spectra were obtained in DMSO-d6 using a UNICAM UV-300 spectrophotometer. The FT-IR spectra were recorded on an FT-IR Nicolet 510 spectrometer using the standard KBr disc technique over the range of 500- 4000 cm-1 with a resolution of Powder XRD spectra of Seifert model ID-300 and nickel channel (λ= 1.5406 Å). The XRD designs were estimated at 2ɵ in the range of 20˚-90˚. Using the Bragg's condition, n = 2dsin, refelection of order and angle were represented by n, it was possible to determine the interlayer dispersion factor d. The block was evaluatedat a repetition rate of 1 kHz using a heap of 20 KN and a course of circular plate-shaped pellets secured with Elteck's silver paste for electrical contact. Inside, the temperature was kept at a controlled 1 0C range (on Schlumberger impedance analyzer)

4. RESULTS

4.1 FT-IR SPECTRA

The Absorption band of aromatic (-OH) actually can be seen in IR spectra of ligand 3420 cm. The presence of a novel band (C-O-M) in the region of 865-988 cm-1 is consistent with the complicated spectra that support coordination through phenolic oxygen in the bonding of metal. The band occurred in the IR scale between 1307 and 1270 cm-1 due to phenolic C-O stretching in free chalcone ligands, demonstrating that just one of the phenolic oxygen atoms from each ligand is deprotonated and involved in coordination with metal [8]. The complexes and ligand show IR bands stretching frequency in the range of 2933-3000 cm-1, 2467-2512 cm-1, and 1122-1618 cm-1corresponding for (=CH of Ar), (-CH=CH) and (-C=O) group of the chalcone based ligand and bands at 1287- 1318 cm-1, 865-988 cm-1 and 765-795 cm-1 for (-C=S), (-C-O-M) and (-C-S-M) bands of a tri-thiocarbonate ligand. The presence of coordinates water is also supported by FT-IR spectra of the complexes. Investigations were conducted regard with the ratio of human cancer cells. Among these, the benzothiazole-2-thiol compounds 7d, 7e, 7f, and 7i with pyridinyl-2-amine links displayed strong and all-encompassing inhibitory effects. The strongest anticancer efficacy against SKRB-3 (IC50 = 1.2 nM), SW620 (IC50 = 4.3 nM), A549 (IC50 = 44 nM), and HepG2 (IC50 = 48 nM) cancer cells [10].

4.2 NMR spectra

Table 3 demonstrates the complex level in 1H & 13C-NMR data. The presence of aromatic proton is confirmed by the multiple in between 7.06 - 8.46 ppm, -CH=CH- band has been confirmed by the signal in a range of 7.10-8.38ppm [9]. While singlet peak of a hydroxyl group in the ligand (L) at 10.80 but due to complexation (-OH) peak not observed in complexes and 13C-NMR signals appears at the range of 128.00- 164, 114.16 – 148 and 180.02 - 198.48 of (Ar-C), (-C=C- of ethylene carbon) and α,β-unsaturated ketones (-C=O).

4.3 Electronic spectra

The UV-Visible spectra show absorbance in the range of 220-480 nm due to n- π* transition of α,β-unsaturated ketones**.** The compound containing double bond moiety i.e chromophoric group (-C=O) absorbed at higher wavelength due to bathochromic shift. B-band arises due to π -π* transition in aromatic 256 nm.

4.4. electrical conductivity in solid states

The complexes' temperature-dependent solid-state electrical conductivity demonstrates their semiconducting nature. Temperature increases are accompanied by an increase in conductivity. One hypothesis is that this behaviour results from the short M—-S and S——S interactions formed by exocyclic sulphur of CS32-.

4.5 Powder XRD Spectra

The complexes' powder X-ray micrographs are depicted in Figures 2-3. The patterns have shown a slight variation in 2, d-spacing, lattice strain, crystallite size, and peak intensity. By contrasting background patterns with those with sharp peaks, the powder XRD scattering of the specimen is used to ascertain the crystalline nature of the complexes. The compounds' powder XRD patterns (Figures 2 and 3) demonstrate their crystalline character [11].

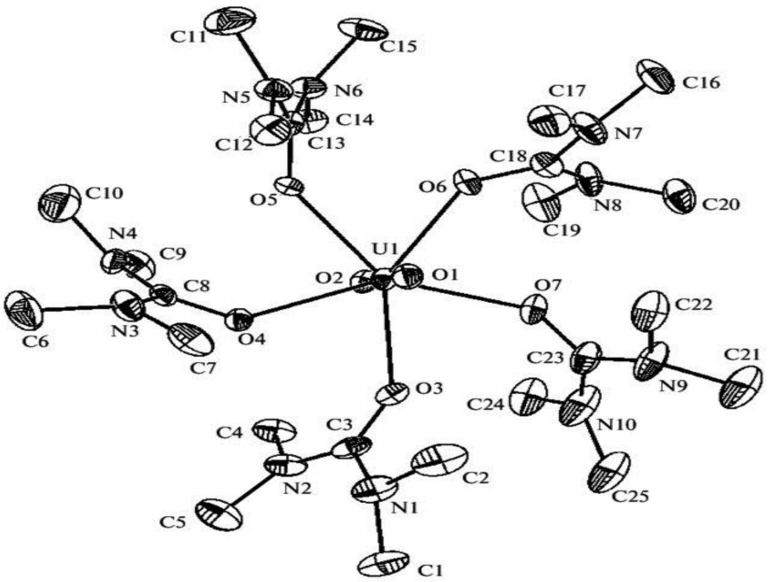


Fig. 2 [Cu(CS3)2][Ni(L)2(H2O)2]

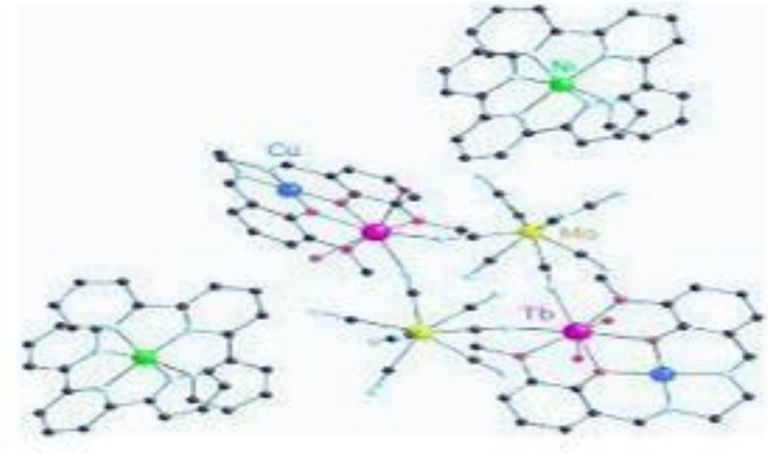
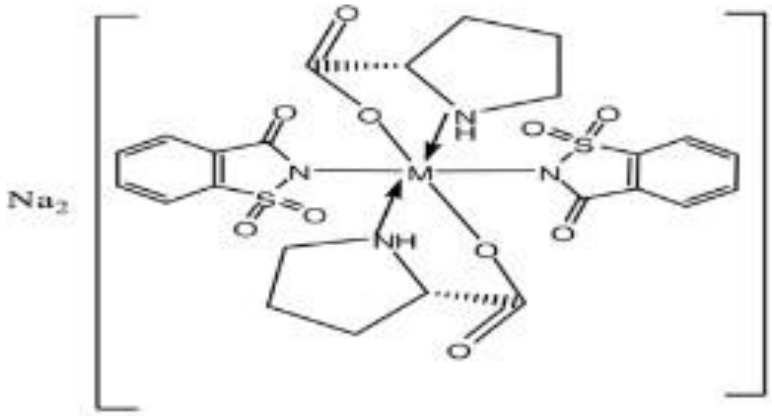


Fig. 3 [Zn(CS3)2][Ni(L)2(H2O)2]



M(II) =Mn(II),Fe(II),Co(II),Ni and Cu(II)

Figure. 4 complexes structure

5. Conclusion:

In accordance with the magnetic susceptibility measurements and EAD, the anionic metallo ligand [M(CS3)2-] [M= Cu(II) or Zn(II)] the central metal atom is aspected to be square planar geometry. In the case of the cationic part of the complex salt, it is assumed to be octahedral geometry around the central metal atom [Fe(II)/ Ni(II) or Co(II)]. The presence of coordinated water is supported by a peak in the IR region. The temperature-dependent solid-state conductivity results show that these compounds are semiconducting.

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