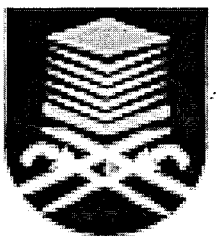
SYNTHESIS AND FOURIER TRANSFORM INFRARED SPECTROSCOPIC STUDIES OF C-O BOND IN THE NICKEL(II) BENZOATE DERIVATIVES SUBSTITUED WITH ELECTRON-ATTRACTING GROUPS



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SEPTEMBER 2003

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CHAPTER 1: INTRODUCTION

Miniaturization of electronic devices increases the reliability and energy saving nature of electronic devices [8]. For the last 10 years or so scientists like Tour and Reed [5] has been enthusiastically studying, synthesizing and isolating molecules exhibiting conductive, semi-conductive and super-conductive ability. One of the major advantage in the manufacturing of molecular electronics is that they are self-assembled, by simply putting the right ingredients into a beaker, unlike time consuming microchip-producing technique. Computing speed can also be revolutionized to millions of times faster than of silicon material [5].

Nickel(II) benzoate is a metallomesogens, a potential low-dimensional electronic material. Its structure is assumed to follow the ligand-field theory [12].

The current research has three main objectives, namely to:

1) Synthesize the derivatives of nickel(II) benzoate, i.e. nickel(II) 4-fluorobenzoate, nickel(II) 4-chlorobenzoate, nickel(II) 4-bromobenzoate and nickel(II) 4-iodobenzoate.

2) Study the effect of electron-attracting substituents attached at the para-position of the benzoato ligand, namely, fluoro, chloro, bromo and iodo, on the strength of the bridging ligand.

The analysis will focus on the wavenumber of C-O bond of the benzoato ligand, which is inversely related to the strength of the bridging bond.

The sample was prepared by reflux method and the product was analysed using Spectrum 2000 Fourier Transform Infrared Spectrometer.

Copper(II) benzoate, a coordination compound has been studied (7), and shown to have electronic properties and thermal stablity. It was thought that nickel(II) benzoate, another coordination compound might contain similar properties and is a potential molecular electronics.

CHAPTER 2: LITERATURE REVIEW

2.1 Metallomesogens and Examples of Metallomesogens

Metallomesogens are metal-containing liquid crystals. Liquid crystals have been known for the last hundred years [1]. It has definite ordered structure (mesomorphic state). Usually composed of flat planar molecules with high degree of symmetry and its properties are electrically affected.

Metallomesogen is a relatively new compound (found in the last twenty years or so [1]). Upon synthesis and characterization it was found to carry properties like colour, magnetism, polarizability and multiple localized charges. Most of its shapes are square planar, octahedral, square pyramidal and lantern structure (rod-like, disc-like structure.). The optical property of metallomesogens are found to show strong birefringence, dichroism and nonlinear optical behaviour. It is paramagnetic and has various orientation in magnetic field. Metallomesogens also show electro-optical properties i.e. a ferroelectric behaviour [2,3].

The most interesting property for a metallomesogens is it can act as low-dimensional conductors. This potential application of metallomesogens in material science is associated with the possibility of electronic communication between metal atoms through π systems of bridging ligands [4].

Follows are some examples of metallomesogens.

2.1.1 Dithene complexes of nickel, palladium and platinum [2]

In general, dithiolato complexes are square planar,and one can imagine a planar terphenyl like structure for complexes of that type (Fig. 2.1). So, first in Grenoble and mostly in Mueller-Westerhoff's laboratory at IBM in San Jose (California), dithene complexes of nickel, platinum and palladium were synthesized and their mesomorphic properties investigated.