1.1 Introduction: -

Potassium hydrogen carbonate is a member of the hydrogen carbonate series of general molecular formula $MHCO_3$ where M is a monovalent element or group ($M^+ = Na^+, K^+, Cs^+$...and/or NH^+_4). These bicarbonate salts are a rather interesting series of compounds which illustrate the effect of crystal packing on the internal structure of covalently bonded molecules [1].

The crystal structures of some members of these salts were determined [1,2,3,4,,5]. The most interesting group in the crystal structure of this series is HCO_3. This group is the source of the hydrogen bonding system characteristic of the structure of these salts. From the available structures, it seems likely that, although as we mentioned above HCO_3 is the main source of hydrogen bonding, the members of this series utilize different hydrogen bonding schemes. For example, $KHCO_3$ contains $(HCO_3)_2^{-2}$ dimers [1,2,3,4], while the hydrogen bonding in the case of $NaHCO_3$[1] and NH_4HCO_3 [5] is arranged in the form of chains.

Potassium hydrogen carbonate, $KHCO_3$ is an interesting member in this series. Its hydrogen bonding system is arranged in the form of dimers like that of carboxylic acids. The general feature of the structure that was given earlier by Nitta et al. [2] has been refined by three-dimensional X-ray diffraction [3] and also by neutron diffraction [4]. Accordingly, the crystals are monoclinic, space group $P2_1/a$ with cell dimensions: a = 1.51725 nm,

b = 0.56283 nm, c = 0.37110 nm, and β = 104.631°. The O-H... O of the dimer is 0.2587 nm.

Different investigators reported on some physical properties of $KHCO_3$ as follows. The mechanism of the proton transfer in the dimer was studied by ^{17}O quadruple double resonance [6]. The anomalous elastic behavior using ultrasonic methods between 250 and 350 K was investigated by Hassuhl[7]. A structural phase transition was observed at ≈318 K [8]. Incoherent neutron scattering has been used for the determination of the effective double minimum potential (DMP) which governs the two-proton jump.

Many investigations have been performed on $KHCO_3$ including incoherent neutron scattering and X-ray diffraction. There have been few studies of dielectric and electrical conductivity of $KHCO_3$ single crystals. The only contributions in our hands are due to[9,10].

The investigation of the fundamental absorption edge can provide extensive information about the band structure of crystals, disorder effects, the character of electron phonon interaction and existence of excitons and their role in the absorption mechanism. Among theories which have been performed to study the Urbach rule those of Sumi and Toyozawa[11], Toyozawa, and schrciber[12], Dow and Redfield[13] and Sketturp[14]. Nevertheless, this point concerning $KHCO_3$ crystals drew less attention among the contributions in the literature.

The aim of the present study:

Potassium hydrogen carbonate crystal exhibit ferroelastic transition at characteristic temperature. Many investigators have studied such transition using different methods, incoherent neutron scattering, X-ray diffraction and ^{17}O quadruple double resonance and the present study aims to throw more light on such transition by using the following: Thermal analysis, Ac conductivity ,Dielectric properties , Optical absorption and Acoustical wave propagation.