Study of Refractive index on non linear optical material of Potasium dihydrogen phosphate, Potasium titanyl phosphate, Potassium niobate

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Abstract: Refractive indices for the crystals potassium dihydgrogen phosphate, potassium titanyl phosphate and potassium niobate are measured. Samples of KDP from different crystal growers had slightly different refractive indices. The refractive indices of KDP for ordinary rays are studied as a function of temperature. The temperature coefficient of the refractive indices has little dependence on the wavelength. From the data obtained the refractive indices and their dependence temperature, wavelength and pressure are discussed.

Keywords: KDP, potassium, pressure, Refractive index, temperature, varariation, wavelength

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INTRODUCTION

Non linear optics is the branch of science that deals with the interaction of light with matter. Physical properties of materials not depend on intensity of light. Non linear optical interaction include second harmonic generation, refractive index, NLO materials applicable to all optical switching, optical power limiting, image manipulation and image processing. The KDP is the well known non linear optical materials. KDP is excellent electro optical crystals with high electro optic co-efficient widely used as electro optical modulators, Q-switches, pocket cell.

The refractive indices are interesting and useful parameters. There are three important factors such as wavelength, temperature and pressure. They affect the refractive indices of the crystals. The ideal non linear crystal not exists. The NLO materials are important for fabrication of electro optic modulators, which convert electric signal into an optical one to transmit into a fiber. Now days, these kinds of devices are manufactured with suitable inorganic NLO materials. In these field, most important parameters of transmission such as exchange and processing of in formations are developing. The refractive index of a material is determined by how quickly light travels through it. Different wavelengths travel at different speeds. Hence the refractive index varies with wavelength. This is known as (chromatic) dispersion. R.I = speed of light in air / speed of light in medium

DEPENDENCE ON WAVELENGTH

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Potassium dihydrogen phosphate KH2PO4 (KDP) is a transparent dielectric material. The refractive index of optical materials is dependent on the wavelength of the incident light.

DEPENDENCE ON TEMPERATURE

Heating a material causes a change in its dimensions. This change in dimensions is expressed by the linear coefficient of thermal expansion. For anisotropic crystals, the thermal expansion is also influenced by the direction of the heat flow.The refractive index, thermal change in refractive index.

DEPENDENCE ON PRESSURE

When pressure is applied, it affects the refractive index in excess of change of compressibility and is explained by the existence of two effects due to pressure. Change in electron density Change in electronic polarizability. First effect produced an increase in refractive index with pressure while the second effect reduces it.

TABLE1.COMPARISON OF REFRACTIVE INDEX FOR DIFFERENT WAVELENGTH

Wave length(μm)	KH_2PO_4	$KTiOPO_4$	$KNbO_3$
0.5	1.5145	1.78554	2.22003
0.6	1.50885	1.76619	2.17761
0.7	1.50482	1.75523	2.15447
0.8	1.50151	1.74825	2.14009
0.9	1.49051	1.74341	2.13032
1	1.49563	1.73981	2.1232
1.1	1.49273	1.73697	2.11769
1.2	1.48975	1.73462	2.11323
1.3	1.48664	1.73257	2.10945
1.4	1.48338	1.73072	2.10614
1.5	1.47994	1.72899	2.10313

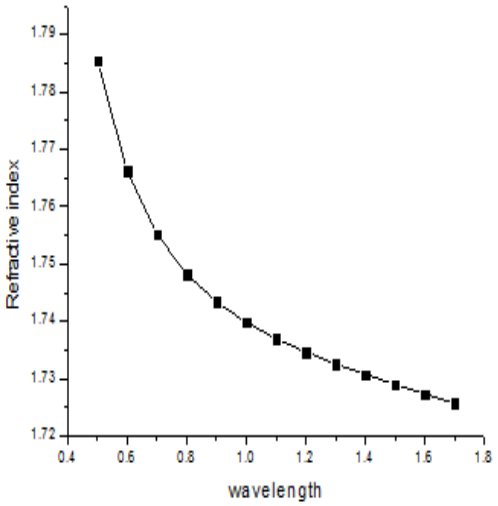

Figure 1.2 Potassium titanyl phosphate

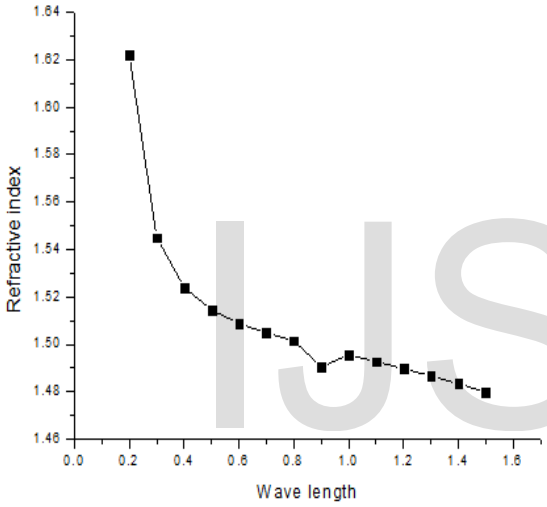

Figure1.1.Potassium dihydrogen phosphate

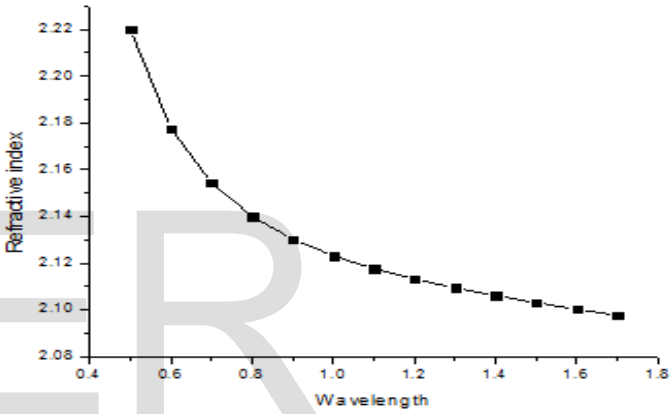

Figure1.3. Potassium niobate

CONCLUSION

The variation of refractive indices with wavelength is shown in Fig1, 2, 3. The wave length range applied to the crystals from 0.2 μm to 1.5 μm. The refractive indices of KH2PO4, KTiOPO4, and KNbO3 decreased. A comparison of refractive indices is given in Table I . Since the refractive indices of KH2PO4, KTiOPO4, KNbO3 decreases with the increasing of wavelength. Since refractive index is a fundamental physical property of a substance, it is often used to identify a particular substance, confirm its purity, or measure its concentration. Refractive index is used to measure solids, liquids, and gases. Most commonly it is used to measure the concentration of a solute in an aqueous solution. For a solution of sugar, the refractive index can be used to determine the sugar content.

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