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GROWTH AND CHARACTERIZATION OF POTASSIUM DIHYDROGEN PHOSPHATE OF SINGALE CRYSTAL

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ABSTRACT:

The homogeneous solutions of potassium dihydrogen phosphate (KDP) crystal the good optical crystal were grown by slow evaporation method. The growth crystal was subjected to various characterizations such as single, powder X-ray diffraction; (XRD) analysis confirmed the crystalline nature of the grown crystal. The obtained XRD pattern matched with well the standard reference data. The KDP single crystals were characterized using UV – visible spectroscopy revealing a wide optical transparency range in the UV to near – IR region. The characteristics of the growth crystal were discussed in detail i.e., cell parameters, optical, function group analysis.

INTRODUTION:

The crystal, with its regular atomic construction, is the most commonly encountered state of solid materials. In the earth's surface, crystals were grown by extreme conditions of high temperature, pressure and other environmental factors. To be specific each crystal starts small and grows as more atoms are added. Many grow from water rich in dissolved minerals, but they can also be grown from melted rock and even vapour. Under the influence of different temperatures and pressures, atoms combine in an amazing array of crystal shapes. The process can take as little as a few days to maybe a thousand years. Crystals that are found in Earth's crust are often formed in this manner. These crystals were formed over a million years ago inside the Earth's crust. They

occurred when the liquid in the Earth consolidates. Crystals are not new to mankind, as they exist in the ancient period. Salt crystals were used in many cultures for food and other purposes. These salt crystals were grown by evaporating seawater in direct sun. In some cultures, pure salt crystals were used as currency and for trading as it was viewed as a precious resource.

Some even waged wars against the salt accusation. The Ancient Egyptians used lapis lazuli, turquoise, carnelian, emerald, and clear quartz in their jewelry. They used some stones for protection and health, and some crystals for cosmetic purposes, like galena and shadow. Every part of the world considers Diamond, sapphire, and Ruby as a valuable resources. In India, the Mughals and other kingdoms used Diamond and Sapphire for exquisite ornaments and necklaces. This was the reason India was constantly colonized by the Mughals and by the British. India is the first country to open mines to produce diamonds Probably the first reference to crystals in Ancient Rome was reported by Pliny the Elder (I Century AD) in his “Natural History”, where he describes windows and greenhouses of the richer inhabitants of the Roman Empire being covered by crystals of "Lapis specular is”, the Latin name for large transparent crystals of gypsum. This dehydrated form of calcium sulphate was extracted by Romans in Segóbriga (Spain) because of its crystal clarity, size (up to one meter), and perfect flatness. The German mathematician, astronomer, and astrologer Johannes Kepler (1571-1630) marvelled when a snowflake landed on his coat showing its perfect six-cornered symmetry. In 1611 Kepler wrote” Six-cornered Snowflake” (Latin title” Sterna Seu de Nivea Hexangular”) the first mathematical description of crystals.

2. MATERIALS AND REAGENTS

- Potassium Dihydrogen Phosphate
- Distilled water
- Glassware (beaker,petri dish)
- Stirring machine

3. PREPARATION OF SOLUTION

Dissolve the desired amount of KDP in distilled water to form a saturated solution. This solution will serve as the growth medium for the crystals. Prepare a separate solution KDP in distilled water. The concentration of KDP will be start stirring.

4. CRYSTALLIZATION

Allow the solution gently to cool and evaporate under the room temperature to promote the crystal growth. A gradual cooling process can help in obtaining larger and more uniform crystals. Optionally seed crystals can be added to facilitate nucleation and promote the growth of larger crystals.

5. PREPARATION OF SEED

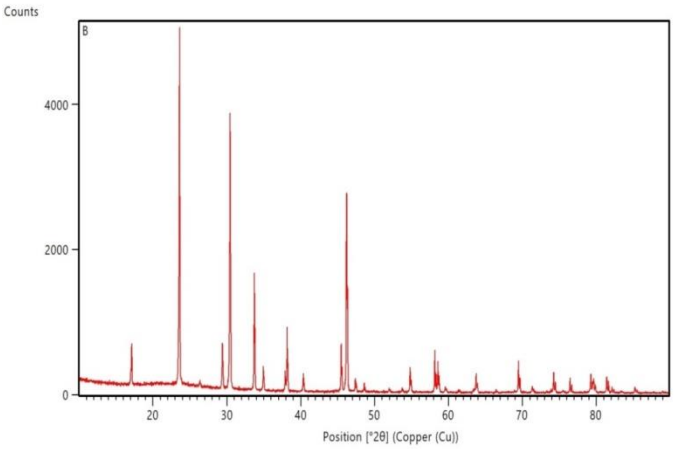
The potassium dihydrogen phosphate materials were taken in equimolar ratio. In added is formed according to the following reaction. The distilled water and stirred at room temperature for 5 hours to achieve the homogenous condition. The potassium dihydrogen phosphate material was synthesized by slow evaporation method tiny crystals also grown. The material was purified by repeated recrystallization. After purification the solution was purification the

solution was prepared for super saturation condition and filtered with whatmann filter paper. The crystal clear solution carefully transferred to 50 ml beaker and closed with pinholes plastic sheet for natural evaporation. After 4 weeks, optically clear crystal was harvested with good dimension 9×3×1 mm^3. Good dimension crystals are very essential for device fabrication and optical applications.

6. RESULTS AND DISCUSSION

6.1 POWDER X-RAY DIFFRACTION PATTERN OF KDP

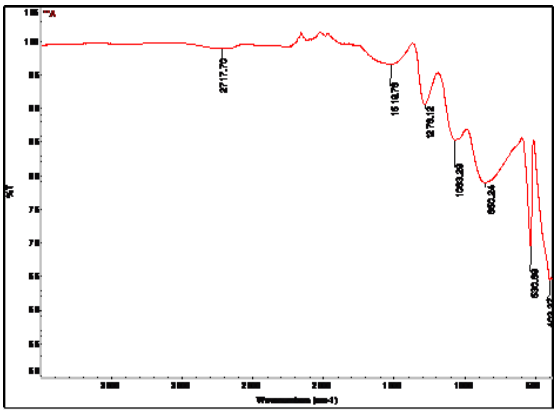
The good optical crystal was powder finely and powder X-ray diffraction characterization using the Bruker Germany D8 Advanced power X-ray diffractometer. The Intensity data were recorded by continuous scan in 2ɷ mode from 10˚ to 90˚ .The recorded X-ray pattern shown in Figure.4.2. The good crystalline nature was confirmed from the single sharp peak. The crystal of tiny was subjected to single crystal x- ray diffraction analysis. Using the Bruker instrument the lattice parameter and space group were found. The lattice parameter of crystal.



XRD pattern of single crystal

6.2 FTIR FTIR SPECTRUM ANALYSIS OF POTASSIUM DIHYDROGEN PHOSPHATE

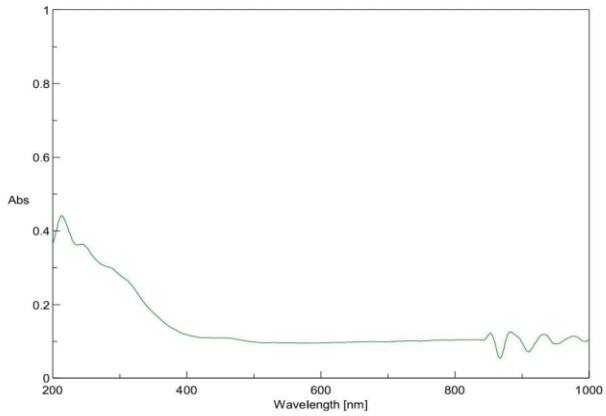
The FTIR analysis of KDP crystal was carried out between the Range of wave number 3500 – 500 cm^{-1} using KBr pellet. The resulting spectrum is shown in fig 4.2. The intense sharp peaks in this band is at 2717 cm^{-1} is assigned to O-H bending vibration. The peak at 1519 cm^{-1} is assigned to c=c bending vibration. The peak at 1278 cm^{-1} is assigned to CH^3 bending vibration. The peak at 1063 cm^{-1} assigned to CH stretching vibration. The peak at 850.24 cm^{-1} assigned to C-H bending vibration. The peak at 530.89 cm^{-1} assigned to C-Br stretching vibration frequency assigned to KDP crystal.



FTIR SPECTRUM

6.3 UV - NIR SPECTRAL STUDIES OF KDP SINGLE CRYSTAL

The UV-Visible spectral study is useful tool to determine the transparency, which is important requirement for a material optically active. The optically transmission of the spectrum of crystal was recorded in the range of 200-1000 nm. using UV-Vis-NIR spectrometer. As the crystal is colourless, its transmission is very high. This is the most desirable property of the crystals used for NLO applications. A large absorption was founded in 210nm in the crystal has very low absorption in entire visible region. The spectrum reveres that cut off wavelength of grown crystal 210nm has wide range transparency in the entire visible region. This optimized for the suitability of opto-electronic application. The optical transmittance of the crystal is form 1000-200 nm there is 100 percentage transmittance of light.



UV – NIR SPECTRAL

7. CONCLUTION

Growth and characterization of potassium dihydrogen phosphate has been successfully synthesised and single crystal have been grown by slow evaporation solution techniques. The main aim of the this is to grow bulk crystals of potassium dihydrogen phosphate. the crystalline nature of the grown crystals was confirmed by x ray diffraction techniques. Unit cell parameters have been evaluated by powder XRD techniques. The crystal XRD data prove that this belongs to TETRAGONAL system. In powder XRD data some additionally peaks were observed in KDP. FTIR analysis confirmed the presence of functional groups in the grown crystal. The linear optical property studies confirmed the transmittance of the grown crystal.

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