Abstract of All Articles, Published by Department of Instrumentation Engineering-USIC, in UGC Care List and Referred Journals, 2009 onwards

1. **Don Biswas, N. S. Panwar & Prolay Sharma, Converse piezoelectric properties of lead free Ba1-xCaxZr0.1Ti0.9O3 (x=0.055) ceramics using double sintered method, Ferroelectrics, 568:1, 95-103, 2020.**

ABSTRACT

The influence of double sintering temperature on the phase structure, micro-structure and piezoelectric properties of Ba1-xCax Zr0.1Ti0.9O3 (x = 0.055) double sintered ceramics has been systematically studied. The pellet sample preparation and characterization have been reported in this paper. The converse piezoelectric properties of the Ba1-xCaxZr0.1Ti0.9O3 (x = 0.055) were observed. Depending upon the sintering temperature, the grain size and density of BCZT ceramics have been changed. The P-E loops, strain%, and the polarization current were measured. The value of d33 was decreasing with the application of an electric field in case of double sintered pellets. For sample x = 0.055, the value of d33 at 1300, 1400 and 1450 ˚C temperature, was 173 (pm/V), 130 (pm/V), and 75 (pm/V), respectively, at applied field 29.33 kV/cm.

2. **Surendra Singh, N. S. Panwar, Temperature-dependent dielectric and structural properties of Li-doped (Na, K) NbO3 near the morphotropic phase region, Journal of Physics and Chemistry of Solids, 146, 109583-109583-8, 2020.**

ABSTRACT

In this study, pellet samples of (Na0.5K0.5)1-yLiyNbO3, (NKLN) y ≤ 0.06, were prepared using a conventional solid state reaction method with double sintering. The temperature-dependent dielectric constant and high temperature X-ray diffraction characteristics of the prepared compositions were observed. Four consistent distinct phases were determined according to the observations as follows. For the compositions where y ≤ 0.02, the phases exhibited monoclinic symmetry between room temperature and about 200 ◦C, tetragonal between about 200 ◦C and 400 ◦C, tetragonal with different symmetry between about 400 ◦C and 460 ◦C (the so-called X phase), and cubic symmetry above about 460 ◦C. For the compositions with higher Li concentrations (y) between 0.03 ≤ y ≤ 0.06, the X phase was not observed and two distinct phase transitions were observed from monoclinic to tetragonal at around 200 ◦C, and from tetragonal to cubic at around 460 ◦C.

3. **Jyotsana Negi, Surendra Singh & N. S. Panwar, Electrical properties of, Na1−0.315K0.315Nb1−yTayO3 (0 ≤ y ≤ 0.05) system, Ferroelectrics, 558:1, 117-127, 2020.**

ABSTRACT

Na0.685K0.315Nb1-yTayO3 (where y = 0, 0.01, 0.02, 0.03, 0.04, 0.05) based ceramics were synthesized by the conventional solid-state reaction process. The effects of (Ta) – doping on the phase structure and electrical properties of (NKNTaO3) were observed. The cell parameters were refined by High Score Plus software, using Rietveld method, The monoclinic Pm(6) space group was chosen in these refinements. X-ray diffraction analysis shows that the crystal structure of the ceramics, without and with Ta-doping possessed monoclinic symmetry. Among the prepared compositions, a break in the XRD peaks shifting tendency was observed at y = 0.03, and also maximum dielectric permittivity, loss tangent and electrical conductivity observed at the composition with y = 0.03.

4. Surendra Singh & N. S. Panwar, Piezoelectric properties of Na1−xKxNbO3, near x = 0.500 morphotropic phase region, Ferroelectrics, 558:1, 240-245, 2020.

ABSTRACT
Sodium-potassium niobate (Na1-xKxNbO3) ceramic pellets were prepared, near equimolar Na-K composition, by solid state reaction method with double sintering. Remnant polarization, coercive field, polarization current and converse piezoelectric coefficient (d*33) of the prepared samples were measured. The observed properties exhibit strong composition dependence- a morphotropic phase transition type behavior, showing extremal piezoelectric properties for potential lead free transducer applications, at the composition with x = 0.500.

5. Gambheer Singh Kathait, M. K. Panda & N. S. Panwar, Preparation of potassium tantalum niobate–barium titanate (KTN-BT) solid solution system ceramics and their piezoelectric properties, Ferroelectrics, 555:1, 109-117, 2020.

ABSTRACT
Potassium tantalum niobate (KTa1-yNbyO3, KTN)-barium titanate (BaTiO3, BT) solid solution system 0.02[KTN]-0.98[BT] ceramics with various microstructures were prepared by modified two-step sintering method, and their dielectric and piezoelectric properties were observed. For 0.02K(Ta0.5Nb0.5)O3-0.98BaTiO3 ceramics ferroelectric tetragonal crystalline structure was found for sintering temperature1230, 1240, 1250, 1260, and 1270 ˚C. A large grain growth was observed for the BT grains of the samples. By observing the strain vs. electric field curves slope apparent piezoelectric constant d33* was investigated. The piezoelectricity d33 is found in proportional to escaping weight % of potassium at increasing sintering temperatures. Enhanced piezoelectric constant d33* of value 391 pm/V was found for sintering temperature 1240 ˚C.

6. Gambheer Singh Kathait & N. S. Panwar, Two-step sintering affecting the escaping of Na and K and its impact on dielectric properties and morphology of lead-free Na0.92K0.08NbO3 ceramics, Ferroelectrics, 554:1, 187-196, 2020.

ABSTRACT
Lead-free NaxK1–xNbO3 (NKN) ceramics with x = 0.08 were prepared by a conventional solid-state reaction method. A two-step sintering technique was used for the sintering of ceramics. In this study, the influence of escaping of Na and K on the physical properties of prepared samples is investigated. It has been observed that the NKN ceramics with sintering temperature 1150 C, 1200 C and 1250 ˚C exhibit quite different microstructures from those with single sintering temperature. The lattice parameter discontinuity previously reported at x = 0.475 has not been confirmed. The permittivity, piezoelectric constant d33, show broad peaks at the sintering temperature 1200 ˚C, where permittivity and d33 are maximum and dependent on the escaping of Na and K. Further, all the ceramics sintered at 1200 ˚C have the high permittivity (ε_c = 3175) and piezoelectric values (d33 = 192 pm/V). From the analyses, we suggest that the high permittivity and piezoelectric properties for the NKN ceramics near 1200 ˚C are closely related to their escaping of Na and K and microstructures of well-faceted and uniformly distributed large grains rather than the widely believed morphotropic phase boundary effect of lattice parameter discontinuity.

7. **Gambheer Singh Kathait, M. K. Panda, N. S. Panwar, Effect of Modified Two-step Sintering Approaches on Potassium Tantalum Niobate–Barium Titanate (KTN-BT) Ceramics and Their Dielectric and Piezoelectric Properties, Science of Sintering, 52, 97-107, 2020.**

ABSTRACT
The Potassium Tantalum Niobate-Barium Titanate (KTN–BT) solid solution system ceramics with the composition 0.02K (Ta0.5Nb0.5) O3-0.98BaTiO3 were prepared by a two-step sintering mechanism, for different sintering durations. Crystalline and microstructure analyses of the prepared samples were performed. Dielectric and piezoelectric properties were also investigated. Moreover, apparent piezoelectric constant d33 was measured using the slope of strain vs. electric field curves for these ceramics. It was observed that the high values of density, electrical conductivity, relative dielectric permittivity (εr = 3615.983), piezoelectric coefficient (d33 = 315 pm/V) and remnant polarization (Pr = 9.53 μC/cm2) were obtained for ceramics prepared through a new variation of the conventional two-step sintering method. Finally, the relationship between sintering mechanism, microstructure and piezoelectricity was discussed for the 0.02K (Ta0.5Nb0.5) O3-0.98BaTiO3 ceramics.

8. **Sidharth Kashyap, S.C. Bhatt, Manish Uniyal, Gambheer Singh Kathait, Structural and dielectric properties of Lead Magnesium Niobate and Ti-doped Lead Magnesium Niobate at room temperature, Materials Today: Proceedings 28, 28–31, 2020.**

ABSTRACT
Lead based relaxor ferroelectric like Lead Magnesium Niobate and their binary solid solutions with Lead Titanate have great interest of research because of their significant and excellent dielectric, piezoelectric and electrostrictive properties. In the present work, the Lead Magnesium Niobate (PMN) and Lead Magnesium Niobate-Lead Titanate (0.75PMN-0.25PT) were prepared through solid state reaction method with double sintering process at 1200 ˚C for 6 hr. XRD data shows the pervoskite structure of the prepared sample. SEM report of PMN and 0.75PMN-0.25PT shows the different microstructure with dense grains. Dielectric study of PMN and 0.75PMN-0.25PT shows the effect of addition of PT content on electrical properties at room temperature.

9. **Gambheer Singh Kathait, Prashant Thapliyal, Don Biswas, Vishal Rohilla & Surendra Singh, Influence of escaping of Na & K on physical properties in lead-free Na0.92K0.08NbO3 ceramic, Ferroelectrics, 551:1, 40-46, 2020.**

ABSTRACT
Lead-free Nax K1–xNbO3 (NKN) ceramic with x = 0.08 was prepared by a conventional solid-state reaction method to investigate the influence of the Escaping of Na & K on their physical properties. It has been found that the NKN ceramics with x = 0.08 exhibit pure perovskite (ABO3) structure. The pure phase NKN was achieved for all sintering temperatures of 1100 ˚C, 1150 ˚C, 1200 ˚C and 1250 ˚C. Change in microstructure, indicates that the grain size increases with the increasing sintering temperatures. The dielectric constant was dependent of the Escaping of Na & K. From the analyses, we suggest that the high dielectric constant for the NKN ceramics near sintering temperature 1150 ˚C are closely related to their low escaping of Na & K and microstructures of uniformly distributed large grains rather than the widely believed morphotropic phase boundary effect of lattice parameter discontinuity.

10. **Gambheer Singh Kathait, N. S. Panwar, Prashant Thapliyal, Don Biswas, Vishal Rohilla, Surendra Singh, Sintering Effect on Electrical Properties and Morphology of Lead-Free Na0.92K0.08NbO3 Ceramics, Science of Sintering, 51, 421-428, 2019.**

ABSTRACT
Sodium potassium niobate (NKN) powders were synthesized by the solid-state reaction method. The NKN ceramics for composition Na0.92K0.08NbO3 (NKN) were then fabricated by a two-step sintering technique. The effects of the two-step sintering on the properties of the ceramics were investigated. The pure phase NKN was achieved for all sintering temperatures of 1100, 1150, 1200 and 1250 oC. The observed change in the microstructure indicates that the grain size increases with the increasing sintering temperatures. Also, the two-step sintering technique produced a higher value of K/(K+Na) weight-% ratio and peak dielectric constant for sintering temperatures 1100, 1150 and 1200 oC. However, further increasing of the sintering temperatures at 1250 oC, reduces the K/(K+Na) weight-% ratio and the peak dielectric constant (єc).

11. **Don Biswas, Gambheer Singh Kathait, Prashant Thapliyal, Vishal Rohilla, Surendra Singh & Jyotsana Negi, Converse piezoelectric properties of K and Namodified (Na1-xKx) NbO3 lead free ceramics for x = 0.08 and 0.17, Ferroelectrics, 550:1, 228-232, 2020.**

ABSTRACT
The effect of potassium content on the structure and piezoelectric properties of the Na1xKxNbO3 (x = 0.08 and 0.17) (SPN) ceramics has been systematically studied. The pellets preparation and characterization have been reported earlier. The piezoelectric properties of the Na1xKxNbO3 (x = 0.08 and 0.17) were observed. The P-E loops, strain%, and the polarization current were observed. The value of d33* increasing with the application of Electric field, the rate of increasing value of d33* for x = 0.08 was faster than compared to x = 0.17. The value of d33* for x = 0.08 and x = 0.17 are 144 (pm/V), 136 (pm/V) respectively at the applied field 44 kV/cm.

12. **Don Biswas, Kuldip Kumar, Vishal Rohilla, Gambheer Singh Kathait, Prashant Thapliyal, Arun Shekhar Bahuguna, Yogendra Pundir, Vinay Prasad tamta, Microcontroller based data acquisition system using error reduction technique, International Journal of Engineering, Science and Technology, Vol. 11, No. 3, pp. 40-48, 2019.**

ABSTRACT
The application of high-speed real-time data acquisition is becoming increasingly wide spread in industrial field, and its measurement accuracy is also increasing. In the present study, the development of a USB based data acquisition system is presented here, where a microcontroller based standalone embedded system is used as data collection and also field control device. The data acquisition system has been calibrated in terms of output voltage generated in signal conditioner. The USB device system also calibrated for the error in the output result. Here USB device has been programmed as Human Interface Device (HID) class, hence not requiring any kind of device specific driver. This data acquisition system is utilized to measure the flow of a channel. The flow of water is not acidic.

13. **V. Lingwal, Binod Kumar Bhadri, A. S. Kandari, and N. S. Panwar, Temperature Dependence of Dielectric Conductivity in KTaxNb1-xO3 System for x ≤ 0.5, International Journal of Advanced Science and Technology, Vol. 28, No. 20, pp. 698 – 705, 2019.**

ABSTRACT
Pellet samples of mixed potassium tantalate niobate (KTaxNb1-xO3), for compositions x = 0, 0.1, 0.2, 0.3, 0.4 and 0.5 were prepared by solid-state reaction method. The calcined mixture was pressed at 0.2 GPa and sintered in a closed furnace to form 8 mm diameter pellets. Temperature variation of dielectric conductivity of the prepared samples has been studied in the frequency range from 0.1 KHz to 1 MHz. Dielectric conductivity has been observed increasing with increasing frequency and with increasing x values, for x ≤ 0.4; for x = 0.5, conductivity decreases at 0.1, 1 and 10 KHz. At 100 and 1000 KHz conductivity decreases for x = 0.3, showing the MPT region. Anomalies have been observed near the transition temperatures of the samples in temperature-dielectric conductivity curves.

14. **Surendra Singh, Jyotsana Negi, N.S. Panwar, Temperature dependent dielectric properties of (na, K) NbO3, near equimolar composition, Ceramics International 45, 13067-13071, 2019.**

ABSTRACT
Pellet samples of Na1-xKxNbO3 (0.490 ≤ x ≤ 0.510) were prepared using solid state reaction method with double sintering. Dielectric measurements were carried out on the prepared samples, from 30 to 500 °C, at 1 MHz. Dielectric constant and electrical conductivity were found minimum, for x = 0.500 among all the prepared compositions, at room temperature and at all the measured frequencies. Three distinguished phase transitions, at 200, 380 and 460 °C, were observed in dielectric measurements of the prepared compositions. The high temperature X-ray diffraction (HT- XRD) of the samples with x = 0.500, shows monoclinic phase between room temperature and 200 °C, tetragonal between 200 and 380 °C, tetragonal with increased lattice parameters, between 380 and 460 °C, and cubic phase beyond 460 °C. The tetragonal to tetragonal phase transition at 380 °C, and tetragonal to cubic at 460 °C was distinctly observed from dielectric and HT- XRD measurements in the present study.

15. **Jyotsana Negi, Surendra Singh & N. S. Panwar, Structural and dielectric anomaly in Na1−xKxNbO3, at x = 0.315, Phase Transitions, https://doi.org/10.1080/01411594.2018.1563789, 2019.**

ABSTRACT
Structural and dielectric properties of sodium-potassium niobate (Na1−x Kx NbO3) (0.250 ≤ x ≤ 0.350) ceramics, prepared by the solid-state reaction method were investigated. Observed dielectric properties show a strong compositional dependence, at all the measured temperatures (from room temperature to 150°C) and frequencies (from 1 to 1000 kHz). In the prepared compositions, the lowest values of dielectric permittivity, loss tangent and electrical conductivity were found, and an anomaly in the shifting pattern of X-ray diffraction (XRD) peaks and change in the slope of a/c vs. x plot were observed at x = 0.315. The observed structural and dielectric anomaly gives a morphotropic phase boundary-like indication, in Na1−xKxNbO3 system, at x = 0.315.

16. **Vijendra Lingwal, A S Kandari & N S Panwar, Theoretical Investigation of Dielectric Properties of Potassium Mixed Sodium Niobate Crystals, International Journal of Management, Technology And Engineering, Vol. 8, Issue IX, 1793-1799, 2018.**

ABSTRACT
Using experimental observed dielectric and loss behavior of potassium mixed sodium niobate crystals the temperature dependence of soft mode frequency, width, relaxation time, order parameter, fourth order coupling coefficients and anharmonic constants have been calculated. Anomaly has been observed in the behavior of soft mode frequency, width, relaxation time, and order parameter, near the transition temperatures in this compound.

17. **Vijendra Lingwal, A S Kandari & N S Panwar, Temperature Dependence of Dielectric Properties in Doped Perovskites, International Journal of Management, Technology and Engineering, Vol. 8, Issue IX, 797-804, 2018.**

ABSTRACT
Pellet samples of mixed sodium-potassium tantalate (Na1-xKxTaO3), for compositions x = 0, 0.2 and 0.5 were prepared by solid-state reaction method. The calcined mixture was pressed at 0.02 MPa and sintered in a closed furnace to form 6 mm diameter pellets. Temperature variation of dielectric constant and loss tangent of the prepared samples has been studied in the frequency range from 10 KHz to 1 MHz. Dielectric anomalies have been observed near the transition temperatures of the samples. Dielectric constant and loss tangent peak heights were observed decreasing with increasing frequency, for all the compositions, which show relaxational behavior of the material.

18. **Surendra Singh, Jyotsana Negi, N.S. Panwar, Dielectric properties of Na1-xKxNbO3, near x = 0.5 morphotropic phase region, Journal of Physics and Chemistry of Solids, 10.1016/j.jpcs.2018.08.018, 2018.**

ABSTRACT
Sodium-potassium niobate (Na1-xKxNbO3) ceramic pellets, with x = 0.490, 0.495, 0.500, 0.505 and 0.510, were prepared by solid state reaction method with double sintering. With varying potassium content (x), dielectric properties and X-ray diffraction (XRD) peaks shifting pattern exhibit strong compositional dependence. Among the prepared compositions, a break in the XRD peaks shifting tendency, and minimum dielectric constant, loss tangent and Electric conductivity indicate a morphotropic phase transition type behavior, at the composition with x = 0.500.

19. **Don Biswas, Gambheer Singh Kathait, Prashant Thapliyal, Vishal Rohilla & Surendra Singh, Temperature dependence of dielectric properties of sodium potassium niobate ceramics for different values of x (Na1−xKxNbO3), Ferroelectrics, 526:1, 168-175, 2018.**

ABSTRACT
Dielectric constant, loss tangent and electrical conductivity of Na1-xKxNbO3 (X = 0.08 and 0.17)(SPN) ceramic pellets have been measured at 10, 100 and 1000 kHz frequencies and at temperature varying from room temperature to 425˚C. The dielectric constant increases with increase of temperature up to 400˚C at all the three frequencies, and thereafter, it decreases with further increase of temperature, i.e., it shows a structural transition at about 400˚C. The loss tangent also shows similar behaviour as dielectric constant shows. Some variations may be due to relaxation effects and impurities etc. around the sensitive transition region, which are seem to play prominent role in this soft mode region. Electrical conductivity increases with increase in temperature at all the three frequencies.

20. Don Biswas, Arun Shekhar Bahuguna, To Measure Physical Signal from Sensor and Control through Data Acquisition System, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 7, Issue 5, 377-388, 2017.

ABSTRACT

The objective of this paper is to acquire data from the sensor or transducer. Also the command signal has been send to the sensor to acquire the data from time to time when the computer needs it. The acquisition system has been modified and it can control the deviated data or output. For this measurement system we develop software using visual basic software. The sensor output has been calibrated into corresponding electrical signal. The measured and acquired data (output of sensor) has been processed through USB based data acquisition system. If there any deviation in the desired output then we can use the control signal to control (computer generated signal) and set it to a desired value. An approach to develop a USB based data acquisition system is presented; where a PIC microcontroller (Microchip's 18F2550) based standalone embedded system is used as a front-end data collection and also field control device. The developed USB based device continuously scans its input analog and digital channels sequentially and updates the PC with these values, which are updated in a Visual BASIC based application GUI (Graphical User Interface). Here USB device has been programmed as Human Interface Device (HID) class, which provides an additional advantage of not requiring any device specific driver. The firmware used in the microcontroller is developed in PicBASICPro platform. A second Generation JDM programmer has been developed, which is used along with WINPIC800 to program the microcontroller. This device can accept an analog input voltage between 0 – 5Vdc from any real life sensor(s) and generate digital output (8 bits) as control action.

21. Vishal Rohilla, Don Biswas, Gambheer Singh Kathait, Prashant Thapliyal, Bharti Ruhela, Estimation of REEs in Some Selected Green /Organic/ Herbal Tea Available in Indian Market, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5, Issue VIII, 1226-1229, 2017.

ABSTRACT

Tea is one of the most consuming and cheap beverages after water all over the world. Tea is a potent stimulant of gastric acid excessive intake cause more acidity in stomach. Most of the population of India is switching from black tea to other herbal products that are marketed in India with name of Green /Organic/ Herbal tea. Studies in the past have shown that Oxides, Nitride and Chloride forms of Rare Earth Elements have adverse effect on human health. Aim of our study is to determine qualitatively as well as quantitatively REEs that present in the Green /Organic/ Herbal tea. To provide an overview of exposure to REEs people are getting by consuming such type of tea. For present work eleven Green /Organic/ Herbal tea samples were procured form local store brew was made and analysis was done on Perkin Elmer NexIon-300x Inductively Coupled Plasma Mass Spectrometer (ICP-MS). Ce was the most abundant element its concentration varied from highest 964.764 µg/L to lowest 73 ng/L. second most abundant elements were Nd, La and Y for some samples. Concentrations of Gd and Dy were found almost similar same was true for Tm and Lu. Lu was found to be least abundant highest 9.336 µg/L and lowest 1 ng/L. Results were observed different from the Black tea in which Ce was found most abundant and La was second most abundant. Keywords: Rare Earth Elements; ICPMS; Herbal tea; Green tea; Organic tea.

22. Vijay Singh Bist and Narayan Singh Panwar, Soft Mode Dynamics of Order-Disorder Type Crystals, Chemical Science Transactions, 6(1), 107-113, 2017.

ABSTRACT

The soft mode dynamics and related properties of order-disorder type crystals have been studied. The phonon width and shift have been calculated, which lead to the renormalization of the relaxation soft-mode. The dielectric properties are directly related to the relaxational soft mode behavior of stochastic motion of H2PO4 groups in order-disorder (KDP-system) crystals. The analysis of the temperature dependence of microwave loss tangent and dielectric constant explain the experimental results.

23. V. Lingwal, A. S. Kandari, N. S. Panwar, Optical properties of sodium niobate thin films, NANOSYSTEMS: PHYSICS, CHEMISTRY, MATHEMATICS, 7 (4), 583–591, 2016.

ABSTRACT

NaNbO3 thin films were deposited under different conditions by rf magnetron sputtering of ceramic target. Spectral transmission of the deposited films was measured in the UV-Visible-near IR range. Films deposited at 300 ◦C showed more absorption, and films annealed at 300 ◦C showed less absorption than those deposited at room temperature (RT), which was found to be consistent with their X-ray diffraction (XRD) patterns. From the observed transmission spectra, refractive index, optical band gap, absorption coefficient, extinction coefficient and film thickness were calculated for the deposited films. Refractive index at 550 nm wavelength was found to be 2.11, 2.01 and 2.34 for the films deposited at RT, 300 ◦C and annealed at 300 ◦C, respectively. The refractive index was found to be almost constant with respect to frequency for the films annealed at 300 ◦C. Optical band gap was found 3.82, 3.7 and 3.81 eV for the films deposited at RT, 300 ◦C, and annealed at 300 ◦C, respectively. Film thickness was shown to decrease with annealing. Absorption and extinction coefficients decreased with increasing wavelength, in all the samples. Band gaps associated with different interactions have been calculated for the deposited films. Phonon assisted indirect forbidden transition was most favorable in the deposited films.

24. V S Bist and N S Panwar, Dielectric Constant and Tangent Loss in Paraelectric Phase for KH2PO4, International Journal of Emerging Technology and Advanced Engineering, Volume 6, Issue 11, 78-84, 2016.

ABSTRACT

By adding third and fourth order phonon anharmonic interaction terms in the four particle cluster model Hamiltonian for the stochastic motion of $H2PO4^-$ groups and using double-time temperature dependent Green's function method and Dyson's equation techniques, expressions for the dielectric constant and dielectric tangent loss have been derived and discussed for KH2PO4. Using model parameters given by Ganguli S, Nath D and Chaudhary B K (Phy. Rev., 1980 B21, 2937) the transverse dielectric constant and observed dielectric constant have been calculated for KH2PO4 in its paraelectric phase. The temperature dependence of this dielectric constant for KH2PO4 have been calculated and compared with experimental results of Raman Intensity (Ferroelectrics, 1983, 52, 91), Bush G (Phys. Acta., 1938,11, 265) and Kaminow I P and Harding G O (Phys. Rev., 1963,129, 1562)], and Deguchi K. and Nakamura E (J. Phys. Soc. Jpn., 1980,49, 1887). The observed dielectric constant explains the Curie-Weiss behaviour of dielectric constant along the c-axis of KH2PO4 crystal in the paraelectric phase. Also the temperature dependence of tangent loss in paraelectric phase for KH2PO4 at 9.2 GHz for field along the a-axis, and c-axis have been calculated and compared with experimental results of Kaminow I P and Harding G O (Phys. Rev., 1963,129, 1562). A good agreement has been found. At higher temperature the loss deviates from the Curie-Weiss type behaviour and increases linearly with temperature. This behaviour suggests that at higher temperature the phonon anharmonicity contributes significantly in the observed loss.

25. Vijay Singh Bist and Narayan Singh Panwar, Study of Dielectric Properties and Ultrasonic Attenuation in KDP-Type Ferroelectrics, Hindawi Publishing Corporation Physics Research International, http://dx.doi.org/10.1155/2016/9475740, Volume 2016.

ABSTRACT

The soft mode dynamical model has been used to study dielectric properties and ultrasonic attenuation in KDP-type ferroelectric crystals. The model Hamiltonian proposed by Blinc and Zeks has been modified by considering lattice anharmonicity up to fourth-order. The correlations appearing in the dynamical equation have been evaluated using double-time thermal retarded Green's functions method and Dyson's equation. Without any decoupling, the higher order correlations, appearing in the dynamical equation, have been evaluated using the renormalized Hamiltonian. The expressions for collective frequencies, width, dielectric constant, ultrasonic attenuation, and tangent loss have been calculated. The dielectric properties and ultrasonic attenuation strongly depend on the relaxational mode behavior of stochastic motion of H2PO4 group in KDP-type ferroelectrics. By fitting model values of physical quantities, the temperature dependence of $\langle Sqz \rangle$ and $\langle Sqx \rangle$ for different value of four-body coupling coefficient and dielectric constant and loss tangent has been calculated. The calculated and observed results have been found in good agreement.

26. Aradhana Bhandari, M. K. Agrawal, N. S. Panwar, Temperature Dependent Dielectric Properties of Monoclinic (H) – Phase [Ta2O5]1-x – [TiO2]x, (0.078 ≤ x ≤ 0.085), IJIRST –International Journal for Innovative Research in Science & Technology, Volume 1, Issue 10, 118-121, 2015.

ABSTRACT

Observed temperature dependence of dielectric constant, loss tangent and dielectric conductivity of H- phase [Ta2O5]1-x- [TiO2]x, (0.078 ≤ x ≤ 0.085) pellets, prepared by solid state reaction method, has been presented. Dielectric constant was observed slowly increasing with temperature showing strong transition peaks at 495, 505, 510 and 520 oC for the compositions with x = 0.078, 0.080, 0.082 and 0.085, respectively. Dielectric loss and conductivity also show anomalous increase near the transition temperature, for all the prepared compositions. Near the transition temperature, anomalous dielectric behavior may be associated with the softening of the active phonon mode.

27. Aradhana Bhandari, M. K. Agrawal, Alok S. Kandari, Vijendra Lingwal, N. S. Panwar, Dielectric Properties of H- Phase [Ta2O5]1-x – [TiO2]x, (0.078 ≤ x ≤ 0.085), IJIRST – International Journal for Innovative Research in Science & Technology, Volume 1, Issue 10, 102-108, 2015.

ABSTRACT

Composition (0.078 ≤ x ≤ 0.085), frequency (1 KHz – 1 MHz) and temperature (30 – 600 oC) dependence of dielectric constant, loss tangent and dielectric conductivity of [Ta2O5]1-x-[TiO2]x pellets, prepared by solid state reaction method, has been presented. The x-ray diffraction patterns and dielectric constant measurements show the occurrence of high- phase. Among the prepared compositions, dielectric constant was observed maximum for the composition with x = 0.080, at all the measured frequencies and temperatures (except near transition temperature). Dielectric properties were observed dominantly driven by composition rather than the frequency or temperature, in the present system. Dielectric constant was observed slowly increasing with temperature showing strong transition peaks at 495, 505, 510 and 520 oC for the compositions with x = 0.078, 0.080, 0.082 and 0.085, respectively. Dielectric loss and conductivity also show anomalous increase near the transition temperature, for all the prepared compositions. Near the transition temperature, anomalous dielectric behavior may be associated with the softening of the active phonon mode.

28. V S Bist, N S Panwar, B S Semwal, Relaxation Time in KDP-Type Ferroelectrics Above Tc, International Journal of Emerging Technology and Advanced Engineering, Volume 5, Issue 10, 317-322, 2015.

ABSTRACT

Using the modified four-particle cluster model Hamiltonian, Green's function method and Dyson's equation techniques. The theoretical expressions for relaxation time, ultrasonic attenuation, dielectric constant and loss have evaluated and discussed for KDP-type ferroelectrics above Tc. From the ultrasonic data the relaxation time has been calculated and compared with the results measured from the other methods. The calculated and observed results have been found in good agreement. By fitting the parameter values the relaxation times obtained from the loss tangent data have been compared with those obtained from the attenuation data. It is observed that these results are in good agreement with each other and with the results obtained by other methods.

29. Vijay Singh Bist, Narayan Singh Panwar and Birendra Singh Semwal, Phase Transitions in KDP-Type Crystals, Chemical Science Transactions, 4(4), 1131-1138, 2015.

ABSTRACT

Curie temperature is determined by investigating the variation of order-parameter $< S^z_q >$ with temperature. The model Hamiltonian proposed by Blinc and Zeks has been modified by considering the lattice anharmonicities up to fourth order. The correlations appearing in the dynamical equation have been evaluated using double-time thermal retarded Green's function and Dyson's equation. The expressions for shift, width, renormalized soft mode frequency, Curie temperature, the expectation value of the proton collective mode components at site q ($< S^z_q >$, and $< S^x_q >$) have been derived and discussed in KDP - type crystals. By fitting model values of physical quantities, the temperature dependence of $< S^z_q >$, and $< S^x_q >$ for different value of four-body coupling have been calculated. The theoretical results are found in good agreement with the experimental results.

30. V. S. Bist & N. S. Panwar, Temperature Dependence of Dielectric Loss Tangent in KDP (KH2PO4) Type Crystals, Global Journal of Science Frontier Research: A Physics and Space Science, Volume 15, Issue 5, 13-20, 2015.

ABSTRACT

Considering third- and fourth-order phonon anharmonic interactions terms in the four particle cluster model Hamiltonian proposed by Blinc *et al* [1982 *J Phys*, C15 4661] for the stochastic motion of - H2PO4 groups for KDP (KH2PO4) type ferroelectrics, expressions for soft mode frequency and loss tangent are evaluated. For the calculations, method of double time temperature dependent Green's function has been used. By fitting model values of physical quantities, the dielectric loss in paraelectric phase of KDP (KH2PO4) crystal at 9.2 GHz for field along the a-axis δa) (tan, and c-axis δc) (tan have been calculated which compare well with experimental results of Kaminow *et al* [1963*Phy Rev*,129 1562]. A good agreement has been found. In the microwave frequency rage, an increase in frequency is followed by an increase in transverse and longitudinal dielectric loss tangent. The loss decreases with increase in temperature for KDP (KH2PO4) crystal, in their paraelectric phase. This shows Curie-Weiss type behavior of the dielectric loss tangent.

31. Mahesh Kumar Agarwal, Aradhana Bhandari, Y. Singh, N. S. Panwar, Optical Properties of Amorphous [Ta2O5]1-x-[TiO2]x (x=0.08) Thin Films, International Journal of Research and Innovations in Science and Technology, Volume 1, Issue 1, 23-29, 2014.

ABSTRACT

Thin films of [Ta2O5]1-x-[TiO2]x film deposited by RF sputtering method. The spectral transmissions of the [Ta2O5]1-x- [TiO2]x (x = 0.08) films were measured in UV-visible range. Films shows good transmittance for as- deposited and sample annealed at 400, 500 and 600 0C. From the observed transmission spectra, refractive index, optical band gap, absorption coefficient, extinction coefficient, and thickness of prepared [Ta2O5]0.92-[TiO2]0.08 films, have been calculated by Swanepoel's envelope technique. Refractive index (n), absorption coefficient (α), and extinction coefficient of the films were observed, generally, decreasing with increasing photon wavelength. The value of refractive index was found 2.29 for sample annealed at 4000C. To understand the associated mechanisms, the energy band gap calculated for all the prepared samples. For the as- deposited films the direct allowed energy band gap was obtained as 4.45 eV; and 4.48, 4.52 and 4.45 eV for the films annealed at 400, 500 and 600 0C, respectively. The observed variation of optical band gap, as a function of annealing temperature, shows that the band gap widens (blue shift) for the films annealed at higher temperatures.

32. V. S. Bist & N. S. Panwar, Temperature Dependence of Inverse Dielectric Susceptibility in KDP-Type Crystals, Global Journal of Science Frontier Research Physics and Space Science, Volume 13, Issue 6, 23-28, 2013.

ABSTRACT

By using four particle cluster model Hamiltonian along with third and fourth order phonon anharmonic interaction terms for KDP-type crystals, expressions for renormalized soft mode frequency, and inverse dielectric susceptibility have been obtained. The method of double time temperature dependent Green's function has been used for calculation. Fitting the values of model parameters, the temperature dependence of soft mode frequency and inverse dielectric susceptibility has been evaluated. The inverse dielectric susceptibility was observed increases linearly with temperature, for KDP crystal, in its paraelectric phase. Theoretical results are compared with experimental results of Kim et al [Physics Review B73, 134114 (2006), and Current Applied Physics 9(2009) 1307]. A good agreement has been found between the reported and present results.

33. V. S. Bist & N. S. Panwar, Temperature Dependence of Relaxation Rate in KH2PO4 above Tc, Global Journal of Science Frontier Research Physics and Space Science, Volume 13, Issue 1, 35-38, 2013.

ABSTRACT

With the help of the modified four-particle cluster model Hamiltonian [GJSFR, 10, 18(2010)], the theoretical expressions for the relaxation rate of polarization fluctuation have been evaluated and discussed for the KH2PO4 (KDP)- type crystals by using the double-time thermal dependent retarded Green's functions techniques and Dyson's equation treatment. The correlations appearing in the dynamic equation have been evaluated using double-time thermal dependent retarded Green's functions techniques and Dyson's equation treatment. Without any decoupling the higher order correlations have been evaluated using the renormalized Hamiltonian. By fitting model values in the theoretical expressions, temperature dependence of relaxation rate is calculated for the KH2PO4 (KDP)-type crystals. Theoretical results are compared with experimental result of Garland and Novotny [1969 Phys Rev. 177 971]. A good agreement has been found.

34. V. S. Bist & N. S. Panwar, Dielectric Properties of Order-Disorder Type Crystals, Global Journal of Science Frontier Research Mathematics and Decision Sciences, Volume 12, Issue 7, 43-56, 2012.

ABSTRACT

The soft mode dynamical model has been used to study the dielectric properties of orderdisorder-type crystals. Using the model Hamiltonian proposed by Blinc [Advances in Phys, 29 (1972) 701] and has been modified by Bist et al [GJSFR,10,18(2010)], the expressions for the dielectric constant and tangent loss have been derived and discussed for order-disorder, KH2PO4 type-crystals with the help of double time temperature dependent Green's function techniques and Dyson's equation treatment. Using appropriate parameters given by Ganguli et al [Phys Rev. B21, 2937 (1980)] the transverse dielectric constant and observed dielectric constant have been calculated and compared with experimental results of Raman Intensity[Ferroelectrics 52, 91 (1983)], Busch [Helv. Phys. Acta. 11, 265 (1938)], Kaminow et al [Phys. Rev. 138A, 1539 (1963)], and Deguchi et al [J. Phys. Soc. Jpn. 49, 1887 (1980)]. The observed dielectric constant explains the Curie-Weiss behaviour of dielectric constant along the c-axis of KH2PO4 crystal in the paraelectric phase. Also the temperature dependence of tangent loss in paraelectric phase for KH2PO4 at 9.2 GHz for field along the a-axis, and the c-axis have been calculated and compared with experimental results of Kaminow et al [Phys. Rev. 138A, 1539 (1963)]. It is observed that these results are in good agreement with each other and with the results obtained by other methods. At higher temperature the loss deviates from the Curie-Weiss type behaviour and increases linearly with temperature. This behaviour suggests that at higher temperatures the phonon anharmonicity contributes significantly in the observed loss.

35. V S Bist , N S Panwar, Relaxation processes and ultrasonic attenuation in KDP type ferroelectrics, Global Journal of Science Frontier Research, Volume 11, Issue 9, 25-30, 2011.

ABSTRACT

The anharmonic four-particle cluster model Hamiltonian for stochastic motion of $H2PO4^-$ groups has been used to study the physical properties of KDP type ferroelectrics. Using Green's function method and Dyson's equation the renormalized frequency of the coupled system and collective wave half width have been evaluated with the help of model Hamiltonian by considering the anharmonicity upto fourth order. The higher order correlations have been decoupled using symmetric decoupling scheme at the later stage after applying the Dyson's treatment and have been evaluated using the renormalized Hamiltonian. The relaxational behaviour and ultrasonic attenuation have been related to the width of collective mode. The temperature dependence of ultrasonic attenuation coefficient, dielectric constant and loss tangent has been discussed in terms of a relaxational soft mode.

36. V S Bist, S C Bhatt, N S Panwar, Temperature dependence of $< S_q^z >$and$< S_q^x >$, collective proton frequency width, collective phonon mode frequency, in paraelectric phase for KH2PO4, Global Journal of Science Frontier Research, Vol. 10, Issue 3, 18-29, 2010.

ABSTRACT

The model Hamiltonian proposed by the [Blinc and Zeks advances in Physics, 29, (1972) 159] has been modified by considering the lattice anharmonicity upto fourth order for the stochastic motion of groups. The correlations appearing in the dynamic equation have been evaluated using double time thermal retarded Green's functions and Dyson's equation. The proton Green's function and phonon Green's function have been evaluated for the collective motion of the system, using model Hamiltonian. The higher order correlations in the proton Green's function have been evaluated using the symmetrical decoupling scheme, after applying the Dyson's treatment. The expressions for the proton renormalized frequency of the coupled system and collective proton wave half widths have been calculated. The higher order correlations in the phonon response function have been calculated without any decoupling and using renormalized Hamiltonian. The expressions for the renormalized phonon frequency and acoustic phonon widths and shifts have been calculated. Using expectation value of the proton collective mode components at site q [Blinc and Zeks advances in Physics, 29, (1972) 159] the temperature dependence of $< S_q^z >$and$< S_q^x >$for different values of, have been calculated. This shows the order of phase transition. In paraelectric phase the value of decreases when temperature increases from transition temperature (TC). Our theoretical results fairly agree with experimentally reported 55-77 result within experimental errors.

37. Aradhana Bhandari, Alok S. Kandari, M. K. Agarwal, Vijendra Lingwal & N. S. Panwar, Sintering Process Dependent Dielectric Properties of [Ta2O5]1-x-[TiO2]x, for the Compositions Near x = 0.08, Ferroelectrics Letters Section, 37:3, 43-54, 2010.

ABSTRACT

Pellet samples of [Ta2O5]1-x-[TiO2]x, (x = 0.078, 0.080, 0.082 and 0.085) were prepared by solid state reaction method. The X-ray diffraction patterns and dielectric constant measurements show the occurrence of low-, mixed- and high-phases with varying sintering processes. The enhanced dielectric constant may be associated with the appearance of monoclinic H-phase. In all the three phases dielectric constant was observed maximum for the composition with x = 0.080, among the prepared compositions. For the Ti modulated Ta2O5 structure the lowest value of the active mode frequency may be held responsible for the observed highest value of dielectric constant for the composition with x = 0.080.

38. Alok Singh Kandari, Vijendra Lingwal, N. S. Panwar, Morphotropic phase boundary in Na1−xKxNbO3, near x = 0.32, Solid State Communications 150, 74–77, 2010.

ABSTRACT

Pellet samples of Na1−xKxNbO3 with x = 0.28, 0.30, 0.32, 0.325 and 0.40 were prepared by a solid state reaction method. X-ray diffraction and dielectric measurements were carried out on the prepared samples. With varying composition (x), a break was observed in the X-ray diffraction peaks shifting tendency; a slope change anomaly in the a/b vs. x plot; and minimum values of dielectric constant, loss tangent and dielectric conductivity, at all the measured frequencies and temperatures, showing a strong compositional dependence of structural and dielectric properties — a morphotropic phase transition, at x = 0.32. The observed minimum values of dielectric parameters may be associated with the increased Na-site vacancies and structural anomaly, at x = 0.32.

39. Alok Singh Kandari, Vijendra Lingwal & N. S. Panwar, Morphotropic Region in Na1-xKxNbO3, Between x = 0.17 and 0.18, Ferroelectrics, 396:1, 18-26, 2010.

ABSTRACT
Pellet samples of Na1−xKxNbO3 ($0.12 \leq x \leq 0.20$) were prepared by solid state reaction method. With varying composition, the observed break in the X- ray diffraction peak shifting tendency, the slope change anomaly in the c/a vs. x plot, and the anomalous change in the dielectric properties identify a morphotropic region in the composition range between x = 0.17 and 0.18.

40. Alok Singh Kandari, Karuna Kandari, Vijendra Lingwal, A. A. Bourai & N. S. Panwar, Composition Dependent Dielectric Anomaly in Na1−xKxNbO3, at x = 0.475, Ferroelectrics, 393:1, 121-129, 2009.

ABSTRACT
Sodium-potassium niobate (Na1−xKxNbO3) pellet samples, with x = 0.40, 0.47, 0.475, 0.48 and 0.50, were prepared by solid state reaction method. With varying composition (x), X-ray diffraction patterns show a break in the peak shifting tendency, at x = 0.475. Lattice parameters calculated from X-ray diffraction patterns show a slope change anomaly, in the a/b vs. x plot, from positive to negative, at x = 0.475. Dielectric constant, loss tangent and dielectric conductivity were found minimum for the composition with x = 0.475, among the prepared compositions, at all measured frequencies and temperatures. The observed results show a strong compositional dependence of dielectric properties, in this system. Observed minimum values of dielectric parameters may be associated with increased Na site vacancies and structural anomaly- a morphotropic type phase transition, at the composition with x = 0.475.

41. Alok Singh Kandari, Aradhana Bhandari, A. A. Bourai, and N. S. Panwar, Electrical Properties of Na1−xKxNbO3 ($0.28 \leq x \leq 0.40$), Ferroelectrics, 386, 139–151, 2009.

ABSTRACT
Sodium potassium niobate (Na1−xKxNbO3) pellet samples, with x = 0.28, 0.30, 0.32, 0.325 and 0.4, were prepared by solid state reaction method. In the XRD patterns a break in the peak shifting tendency was observed for the composition with x = 0.32. Dielectric constant, loss tangent and dielectric conductivity of the prepared samples were measured in the frequency range from 10 to 1000 KHz, and in the temperature range from 30 to 500◦C. Transition temperatures determined from the dielectric constant measurements were found independent of the measured frequencies, and no relaxator type behavior was observed for the presently prepared compositions. Dielectric constant and loss tangent were observed decreasing, and dielectric conductivity increasing with increasing frequency. Weak loss tangent anomalies were observed, near the transition temperatures. Transition anomalies observed from the dielectric conductivity measurements were consistent with those from the dielectric constant measurements. Among the prepared compositions dielectric constant, loss tangent and dielectric conductivity were observed minimum for Na0.68K0.32NbO3, at different frequencies and temperatures, which indicate a strong composition dependence of the electrical properties. Among the prepared n-type Na1−xKxNbO3 compositions, an increase in the Na site vacancies and structural anomaly may be held responsible for the observed minimum dielectric conductivity of the composition with x = 0.32.