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Effects of wave function modulation on high-frequency carrier transport in quantum wells under high biasing field

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Abstract : The effects of wave function modulation on the high frequency response of GaAs/AlAs quantum wells with several thin barrier layers being inserted inside the wells are studied. Carrier scattering by longitudinal optic phonons, deformation potential acoustic phonons and background-ionized impurities are considered. The wave function modulation induced inside the quantum well is found to reduce the scattering strength and reduces the ac mobility normalized by the dc mobility because the enhancement rate of dc mobility is much higher than the ac values. The variation of ac mobility normalized by dc mobility with the frequency of the applied field is found to be fairly constant upto a certain frequency beyond which it drops down.

Keywords : Wave function modulation, quantum wells, carrier transport, carrier scattering, optic phonons

PACS Nos. : 73.63.Hs, 72.20.Ht

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Dependence of U, V, W and other profile shape related parameters on standard Si sample microstructure

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Abstract : Individual profile and whole pattern fitting method with and without any micro-structural constraints, were done using split pseudo-Voigt, split Pearson-VII and symmetric pseudo-Voigt convoluted with an asymmetric function to functions on a specially prepared standard Si-sample. The values of Caglioti parameters U, V, W and profile shape parameters (*viz.* Lorentzian content and profile tail decay rates) are modified by the inclusion of micro-structural parameters in the refinement process. The critical analysis with different specimen clearly shows that for cases with considerable broadening whole or individual profile fitting can be adopted successfully. But for marginally broadened case, the correct procedure will be to adopt only whole profile fitting process with micro-structural constraints and not with individual profile fitting technique.

Keywords : X-ray powder profile, fitting parameters, standard silicon

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Characterization of GaS-deposited GaAs surface by XPS and PL

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Abstract : The passivation effects of GaAs surfaces by sulfur are introduced. The thermal evaporation of a GaS single crystal has been used to passivate the GaAs surface. The passivation effect of GaAs surface by GaS has been studied by X-ray photoelectron spectroscopy (XPS) and photoluminescence (PL). The XPS spectra show that Ga-S bonds are found to be more stable than As-S bonds. These Ga-S bonds are responsible for the passivation of GaAs surfaces. PL measurements suggest that the GaAs surface is effectively passivated by a GaS films. Staggered type of band alignment has been observed at the GaS/GaAs interface.

Keywords : GaAs, GaS, XPS, PL, passivation

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Growth and characterisation of potassium dihydrogen phosphate (KDP) crystal doped with amino acids

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Abstract : Pure and amino acid doped potassium dihydrogen phosphate (KDP) crystals have been grown by solution technique at room temperature. The powder X – ray diffraction studies for the grown crystals have been made. The dielectric behaviour of the pure and doped crystals has been studied in the microwave region using K – band microwave bench equipped with the Gunn oscillator and guided with rectangular wave guide. The grown crystals are subjected to Thermogravimetry Analysis (TGA) and Differential Scanning Calorimetry (DSC), in order to identify the changes in the thermal stability and structural phase transitions.

Keywords : Growth of KDP crystals, doping effect, amino acids

PACS Nos. : 77.84.Fa, 77.84.Lf, 61.10.Nz, 81.70.Pg

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Quantitative determination of haematite and chalcopyrite in metamorphic rocks using infrared spectroscopy

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Abstract : The infrared spectroscopic analysis of metamorphic rock samples from Mamandur multimineral complex was investigated. Infrared spectra (4000 cm^{-1} to 200cm^{-1}) were obtained for 24 samples collected from different sites and altitudes of Mamandur hills. The observed results show the presence of quartz, microcline feldspar, sillimanite, magnetite, haematite, chalcopyrite and sphalerite minerals. The presence of the peak at 695cm^{-1} confirms the crystallinity of quartz. The quantitative analysis of iron bearing mineral (haematite) and copper bearing mineral (chalcopyrite) yields an average amount of 14.9% and 4.6% respectively.

Keywords : FTIR, mineral identification, chalcopyrite, haematite

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Mechanoluminescence produced during impulsive deformation of coloured alkali halide crystals

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Abstract : Mechanoluminescence (ML) in coloured alkali halide crystals is reported. During impulsive excitation of g-irradiated alkali halide crystals, two peaks are observed in the ML intensity *versus* time curves. The first peak lies in the deformation region and the second peak in the post-deformation region. The ML in the deformation region is due to the recombination of dislocation-trapped electrons with the holes in defect centres. The ML in the post-deformation region is due to the transient thermostimulated luminescence from shallow traps which get populated due to the Auger process occurring during transfer of dislocation-trapped electrons to deep traps. In the frame work of the mechanism proposed, an equation is derived which is able to explain the ML in the deformation and post-deformation region of the crystal. Several other facts related to the ML produced during impulsive excitation of coloured alkali halide crystals, are also discussed.

Keywords : Mechanoluminescence, dislocations, deformation, alkali halides.

PACS Nos. : 78.60.-b, 61.72.y

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Effects of temperature on the mechano luminescence of gold-doped ZnS phosphors

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Abstract : The present paper reports the effects of temperature on the mechanoluminescence (ML) intensity of gold-doped ZnS phosphors. The ML intensity decreases with temperature and follows the relation $I_T = I_T^0 \left[1 - T/T_c\right]^n$ the value of n lies between 0.90 and 1.10 for ZnS phosphors. Generally, ML of ZnS phosphors ceases much below their melting point. The process of thermal quenching in the ML can be understood by electro and photoluminescence (PL) studies. The faster rate of decrease of ML intensity than the PL intensity suggests that in addition to increase in the non- radiative transition probability, the temperature also affects some other parameters such as piezoelectric constant or surface charge density responsible for the ML excitation.

Keywords : Mechanoluminescence (ML), electroluminescence (EL), photoluminescence (PL)

PACS Nos. : 78.55.-m, 78.60.Fi

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Thermally stimulated conductivity of CaS phosphors activated by Ce

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Abstract : Thermally Stimulated Conductivity (TSC) study has been made on CaS:Ce phosphors, prepared with different activator concentrations. Energies of trap levels corresponding to peaks were calculated using three different methods. Trap depths/activation energy, relaxation time and attempts to escape frequency are evaluated. The variation in the values of trap depths is studied for the observation of TSC of g-irradiated phosphors.

Keywords : Thermally stimulated conductivity (TSC), doping, phosphors.

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I J P

Thermo-optical studies of nematic liquid crystal mixtures

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Abstract : Integrated optical transmittance (IOT) and differential scanning calorimeter (DSC) studies of two nematic liquid crystal mixtures (ZLI- 3497-100 and ZLI-3741) were made for phase transition measurements, during both heating and cooling cycles. Transition temperatures, transition enthalpies (ΔH) and entropies (ΔS) have been determined using DSC technique.

The IOT and DSC studies indicated good agreement for the transition temperatures for the both mesogens, which exhibited broad nematic – isotropic phase transition. The different peaks observed in IOT studies during phase transitions seems to correspond to different constituents of the mesogens.

Keywords : IOT, DSC, phase transition, liquid crystal mixtures.

PACS Nos. : 64.70.Md, 05.70.Fh

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Intramolecular C-H...N and intermolecular N-H...N interactions in 2-amino-4-phenyl-1,3-thiazole

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Abstract : The crystal structure of 2-amino-4-phenyl-1, 3-thiazole derivative has been determined by X-ray diffraction methods with an aim of describing intra- and intermolecular interactions in thiazoles. The title compound crystallizes in tetragonal space group $P4_1$ and its structure has been refined upto the reliability index of 5%. There occurs N-H...N bond at a distance of 2.19 and 3.01Å, respectivley and it appears to be formed by symmetry-related amino atom and nitrogen atom of the parental thiazole ring. The crystal cohesion is pronounced, may be due to an intramolecular phenyl-thiazole C-H...N interaction.

Keywords : Structure analysis, crystal data, packing interactions, symmetry code.

PACS Nos. : 61.10.Nz, 61.50.Ah

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Electron-phonon resonance in some new charge transfer complexes

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Abstract : Some new charge transfer complexes of organic donors and acceptors were prepared and the infrared spectra in the range 400-4000 cm^{-1} were obtained. The analysis of featureless absorption between the two envelopes at 1400 cm^{-1} and 3400 cm^{-1} were carried out for the transitions across the band gap. Six complexes show spectral characteristic of the presence of charge density waves. Electron–phonon resonance is found. Bands are ascribed to various intramolecular bond vibrations of donor and acceptors. Systematic distortion of the Gaussian band as the occurrence of electron – phonon resonance is discussed. Other four complexes show variation of the band gap.

Keywords : Infrared spectra, charge transfer complexes, Gaussian bands, optical absorption edge, election-phonon resonance.

PACS Nos. : 78.30.-j, 87.15.Mi

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Chemical analysis techniques for quantitative determination of Cd, Se and Te from thin $CdSe_{1-x}Te_x$ films

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Abstract : A method is proposed for the chemical compositional analysis of the mixed semiconducting thin films. The technique is presently used for extraction, separation and spectrophotometric determination of cadmium (II), selenium (IV) and tellurium (IV) from sulphuric acid and hydrochloric acid media with 4'-bromo PTPT in chloroform. This method is sensitive, rapid, reproducible and has been satisfactorily applied for the separation and determination of trace amounts of Cd, Se and Te from $CdSe_{1-x}Te_x$ thin films. The results are compared with analysis of these films by an EDS technique.

Keywords : Chemical analysis, semiconducting thin films, PAR reagent, 4'-bromo PTPT.

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On the diffraction model approach to cluster stripping nuclear reactions

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Abstract : In this study, the diffraction model is employed to study the cluster stripping nuclear reaction on the basis of the Regge-pole method. A formula for the angular distribution is derived. The angular distribution spectra for the cluster stripping nuclear reactions ^{40}Ca(^{3}He,p)^{42}Sc, ^{40}Ca (t,p)^{42}Ca and ^{54}Fe(t,p)^{56}Fe at various energies have been well reproduced with projectile energies varying between 10 MeV and 15 MeV. The predicted theoretical results for the cluster stripping reactions ^{40}Ca (^{3}He,p)^{42}Sc with 10 MeV, 12 MeV and 15 MeV incident ^{3}He; ^{40}Ca (t,p)^{42}Ca with 10.1 MeV incident triton; and ^{54}Fe(t,p)^{56}Fe with 12 MeV incident triton were compared with the experimental data and good agreement was observed. Also a comparison between the diffraction model prediction of the angular distribution values for the cluster stripping reaction ^{40}Ca(^{3}He,p)^{42}Sc at energy 12 MeV of ^{3}He and that of the distorted-wave Born approximation (DWBA) is implemented and a satisfactory agreement between the two methods has been attained.

Keywords : Cluster stripping nuclear reactions, diffraction model, Regge-pole, angular distribution, DWBA model

PACS Nos. : 24.10.Ht, 24.10.Eq

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Halo structure of ^{11}Li in a simple three body model

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Abstract : The three body model of ^{11}Li employing non-local separable potentials in momentum space proposed earlier (S Kumar and V S Bhasin *Phys. Rev.* **C65** 034007 (2002)) is employed to reproduce structural properties of ^{11}Li like probability distribution, matter radius, momentum distributions and n-n correlation. The energy positions and widths of resonant states of ^{11}Li above the breakup threshold have been calculated using the complex scaling method. The model is further extended to study the β-decay of ^{11}Li to deuteron + ^{9}Li channel and to ^{11}Be* (18.3 MeV) state.

Keywords : Halo structure, complex scaling method, n-n correlation, β-decay

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Strong azimuthal fluctuations of pions produced in nuclear interactions at a few GeV/n

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Abstract : This paper presents a detailed study on the azimuthal fluctuations of the pions produced in nuclear emulsion from high energy relativistic interactions initiated by ^{16}O-AgBr at 2.1AGeV , ^{12}C-AgBr interactions at 4.5 AGeV and ^{24}Mg –AgBr interactions at 4.5AGeV. The outcome of this analysis signifies the existence of strong azimuthal asymmetry in the multipion production process. Asymmetry is also found to depend on the number of pions produced.

Keywords : Azimuthal asymmetry, pionisation, relativistic nucleus-nucleus collisions

PACS Nos. : 25.75.-q, 24.60.Ky

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Note

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Crystal and molecular structure of bis(2,4-diaminopyrimidinium) phosphate monohydrate, $2C_4H_7N_4^+.PO_4^{3-}.H_2O^+$

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Abstract : The crystal and molecular structure of bis(2,4-diaminopyrimidinium) phosphate monohydrate, $2C_4H_7N_4^+.PO_4^{3-}.H_3O^+$ has been determined by X-ray crystallographic method. The crystal belongs to the monoclinic space group $P2_1/a$ with cell dimensions a = 20.992(2), b = 6.948(1), c = 10.083(1) Å and β = 102.15 (1)°. The asymmetric unit of the structure consists of one phosphate ion, one water molecule and two 2,4-diaminopyrimidine (DAP) molecules stacked parallel to the b direction with average perpendicular separations of 3.311(4) and 3.344(4)Å, respectively. The tilt angle between the least squares planes of the two DAP molecules in the asymmetric unit is 2.0(1)º. The structure is stabilized by stacking forces, N–H···N and N–H···O hydrogen bonds.

Keywords : 2,4-diaminopyrimidinium, dihydrofolate reductase (DHFR) inhibitor, bis(2,4-diamino pyrimidinium) phosphate monohydrate, Crystal structure of $2C_4H_7N_4^+PO_4^{3-}.H_3^+$.

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Note

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Structure of 1-cyano, 1-carbethoxy-2-(3' methoxy-4'-hydroxy) phenyl ethylene

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Abstract : The title compound [$\mathbf{C_{13}H_{13}O_4N}$] has been taken up for study as it shows non-linear optical (NLO) properties with an electron withdrawing group at one end and an electron donating group at the other, with an extended conjugation in between. The crystal structure has been determined at room temperature. Needle like crystals of the compound crystallizes in monoclinic system, space group $P2_1/n$ with cell dimensions a = 10.646(3)Å, b = 9.351(4)Å, c = 12.647(5)Å, β = 97.13(3)° and Z = 4. The structure was solved by direct method and refined by full-matrix least-squares method to a final R = 0.046 for 1993 observed reflections. The molecule on the whole is almost planar, the methoxy group makes a dihedral angle of 0.7° with planar phenyl ring. The carbethoxy moiety forms an extended planar zigzag chain with the neighboring atoms. The molecules are held by strong O-H....O, C-H....O and C-H....N inter- and intra- molecular hydrogen bonds.

Keywords : Phenyl ethylene, X-ray crystallography

PACS No. : 61.10.-i