

Variability of Indian monsoon and its rainfall forecasting

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Abstract : The present state of knowledge on the variability of Indian monsoon with special emphasis on the intra-seasonal and inter-annual variation of the monsoon giving importance to 'monsoon jets', seasonal oscillations, annual variability and coherent intra-seasonal oscillations are discussed at length. Different techniques and models implemented for forecasting monsoon rainfall have been thoroughly considered. A link between stratosphere and monsoon rainfall is examined. The instability characteristics of monsoon disturbances are outlined. Finally, scope of future investigations are pointed out.

Keywords : Monsoon, rainfall, instability characteristics

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Neuro-fuzzy modelling of the strength of thermomechanically processed HSLA steels

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Abstract : The mechanical properties of HSLA steels are modelled by the application of neuro-fuzzy systems in respect of the effect of composition and process parameters. Neuro-fuzzy system generated through data clustering showed a good performance from the prediction point of view. Also the increase in the number of rules improved the predictability of the system. A new design of neuro-fuzzy system through division in sub-classes has enabled the system to model a complicated system of non-linear input-output relationship.

Keywords : HSLA steel, mechanical property, neuro-fuzzy system, prediction

PACS Nos. : 81.05.Bx, 84.35.+i, 07.05.Mh

Magnetization studies of spinel oxides $\text{Zn}_x\text{Ni}_{1-x}\text{FeCrO}_4$ ($0.2 \leq x \leq 0.8$)

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Abstract : The spinel system $\text{Zn}_x\text{Ni}_{1-x}\text{FeCrO}_4$ ($x = 0.2, 0.4, 0.6$ and 0.8) are prepared by the ceramic sintering method. X-ray diffraction results show that all the samples have single phase spinel structure. Using a Vibrating Sample Magnetometer (VSM), the temperature-dependence and the field-dependence of magnetization measurements have been carried out. From the temperature-dependence of magnetization, ferrimagnetic ordering temperature (T_C) and from the hysteresis curves, the values of the saturation magnetization (M_s), coercive force (H_C) have been determined for the different compositions. It is observed that with the increase of diamagnetic substitution, the value of saturation magnetization first increases and then decreases, the optimum value of the diamagnetic Zn substitution being 0.5. The variation of the net magnetic moment with Zn substitution has been discussed in terms of the distribution of magnetic and non-magnetic ions over the A and B sub-lattices and their exchange coupling. The ferrimagnetic transition temperature and coercive force decrease with increasing Zn contents in $\text{Zn}_x\text{Ni}_{1-x}\text{FeCrO}_4$.

Keywords : Spinel ferrite, magnetic properties, coercivity, magnetization, ferrimagnetic

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Deep level studies of GaN by deep level transient spectroscopy

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Abstract : Deep level studies of undoped, lightly-doped and moderately-doped GaN have been done, the dopant being Mg. An energy level of $L_1 = 0.25$ eV has been observed in all three types of samples and is considered to be due to unintentional dopant/impurity present in the grown sample. The concentration of this L_1 level is independent of doping level. Another level $L_3 = 0.62$ eV has been observed in lightly-doped and moderately-doped samples. The concentration of this L_3 level depends on the doping concentration and is considered to be due to Mg dopant. Another broad energy level L_2 has been observed only in lightly-doped sample but does not appear in undoped and moderately-doped sample. The broadening and peak height of this L_2 level are attributed to the contribution of more than one deep level. The origin and disappearance of this L_2 level in undoped and moderately-doped sample is not clear.

Keywords : Deep level, activation energy, trap density, GaN

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Space charge limited positive and negative photoconductivity in CdTe thin films

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Abstract : Thermally evaporated CdTe thin films having thickness in the range of 1000—4700Å and deposited within the substrate temperature 473K – 583K, show weak crystallinity and cause both space charge limited positive and negative photoconductivity. The occurrence of negative photoconductivity depends on the applied field, temperature and the illumination level, which is governed by the minority carrier holes optically freed from the trapping centers. The prime deep trap depths responsible for negative photoconductivity are 0.514 ± 0.002 eV and 0.516 ± 0.002 eV estimated from thermally stimulated current as well as SCLC measurements. The positions of electron Fermi level and recombination centers are calculated as 0.57eV and 0.77eV for *n*-type CdTe thin films.

Keywords : CdTe thin film, negative photoconductivity, annealing, defects, SCLC mechanism

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Dielectric studies of gel grown zinc tartrate crystals

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Abstract : Zinc dextro tartrate and zinc levo tartrate crystals were grown by using optically sensitive dextro tartaric acid and levo tartaric acid, respectively. These crystals were grown by a single diffusion gel growth technique using silica hydro gel. The variation in dielectric constant and loss tangent values, for both zinc dextro tartrate and zinc levo tartrate crystalline samples, was measured at different temperatures in the frequency range from 5 kHz to 1 MHz. A sharp peak was observed in the dielectric constant *versus* temperature plots at 121.52 °C indicating a phase transition. Beyond this temperature, the Curie- Weiss law was found to be followed. The variation of the dielectric constant with frequency was also studied. The results are discussed.

Keywords : Zinc tartrate, spherulitic crystals, dielectric behaviour, tangent loss, Curie- Weiss plot, gel growth

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Fourier transform infrared and Fourier transform Raman spectra and normal co-ordinate analysis of benzocaine

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Abstract : Benzocaine is one of the important local anaesthetic with molecular formula $C_9H_{11}NO_2$. This has been used as a cutting agent in the illicit drugs. Fourier transform infrared (FTIR) and Fourier transform Raman (FTR) spectra of benzocaine contain a number of bands at specific wave numbers. A detailed vibrational analysis has been made in deciding which of the vibrational modes gives rise to each of these observed modes. A normal coordinate analysis has been carried out for benzocaine assuming the ethyl group as point mass. A set of molecular constants has been evaluated on the basis of C_s symmetry. The evaluated potential constants have been compared with those of related molecules and are in good agreement with the literature. To check whether the chosen set of normal coordinates contribute maximum to the potential energy associated with the normal coordinates of the molecule, potential energy distribution (PED) has been evaluated.

Keywords : Benzocaine, Fourier transform infrared spectrum, Fourier transform Raman spectrum, normal coordinate analysis, potential energy distribution

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Stimulated Raman scattering instability of laser beam propagating through a collisional plasma in a self-focused filament

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Abstract : The stimulated Raman scattering instability is treated for laser beam propagating through a collisional plasma in a self-focused filament where nonlinear refraction due to the redistribution of the electron density caused by nonuniform ohmic heating of electron is balanced by diffraction divergence. The filament supports radially localized Langmuir waves. A high power laser beam propagating through a collisional plasma breaks into high-intensity filaments of size $\sim c/\omega_p$ where c is the velocity of light in vacuum and ω_p is the plasma frequency. Inside a filament, the laser undergoes stimulated Raman backscattering (B-SRS). Since the temperature inside a filament is higher and density is lower than those outside, the collisional damping rates of the decay waves are lowered and hence, the threshold power for B-SRS is reduced. It is shown that self-focusing of perturbations in the incident laser beam can greatly enhance the growth rate of the instability. This result may help to explain experimental observation of Raman scattering at nominal incident intensities well below the theoretical threshold.

Keywords : Stimulated Raman scattering instability, collisional plasma, self-focused filament.

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Speed and shape of electron acoustic solitary waves in plasma

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Abstract : Large amplitude electron acoustic solitary waves are investigated in a two temperature plasma with finite ion-temperature. The Sagdeev's pseudopotential is derived in terms of cold electron speed (u_c). It is found that there exists a critical value of u_c (u_{oc}) at which $u'_c = 0$ beyond which the solitary waves cease to exist. This critical value also depends on T_c , the normalized cold electron temperature.

Keywords : Solitary wave, pseudopotential, electron inertia, soliton solution

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Differential cross sections for $\bar{e}$ - CO elastic scattering

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Abstract : In a recent investigation, Raj and Kumar [*Phys. Lett. A* **282** 284 (2001)] modified the absorption potential of Staszewska *et al* [*Phys. Rev. A* **28** 2740 (1983)] in such a way that it yielded the best agreement between theory and experiment for elastic cross sections when applied to e^-O_2 scattering over a wide incident energy range. In the present investigation, the same modified absorption potential of Raj and Kumar has been employed to obtain the elastic differential cross sections (EDCS) for electron scattering by CO molecules at intermediate energies (100-800 eV). The independent atom model alongwith partial waves has been used for these calculations. The present results of EDCS are in fairly good agreement with the experimental data.

Keywords : Differential cross section, electron, CO molecule, independent atom model

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Luminescence and upconversion process in $\text{Er}^{3+}:\text{TeO}_2\text{-Na}_2\text{CO}_3$ glasses

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Abstract : The photoluminescence properties of Er^{3+} -doped alkali telluride glasses are investigated. The matrix system is $80\text{Te}_2\text{O}_2\text{-}20\text{Na}_2\text{CO}_3\text{-Er}_2\text{O}_3$. We grew glasses at varying concentrations of Er from 0.5% to 2.5%. The Stokes luminescence characteristics under 380nm excitation have been studied and intense green emission was observed from samples of Er^{3+} doped glassy material. Infrared to visible upconversion has been observed under IR at 800nm excitation. Visible upconversion center at 540nm corresponding to the $^4\text{S}_{3/2} \rightarrow ^4\text{I}_{15/2}$ in Er, sharp intense green emission occurs when concentration of Er_2O_3 is about 1.5 mol%. Excited state absorption is discussed as possible mechanisms for the upconversion process under IR excitation.

Keywords : Upconversion, erbium, tellurium oxide

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