

regard to air pollution caused by two wheelers – ‘vehicle of the poor’ – she said that ‘no research was being done on this by Indian scientists’. She also called for ‘new rockstar scientists’. Sharachandra Lele, Centre for Interdisciplinary Studies in Environment and Development, Bangalore described scientists as playing a double game in relation to socially relevant science. They possessed a ‘scientist’s schizophrenia’ with an aura of objectivity or consensus in regard to sustainability. He spoke of the need for a self-reflective, value-sensitive science and the ‘arrogance of the natural sciences’ that do not want to engage in socially relevant science. He felt that the mission statement of the Department of Space did not mention ‘people’, and he also called for a renaming of INSA to ‘INNSSA to stand for

Indian National Natural Sciences and Social Sciences Academy’.

Many in the audience felt that there could have been a greater mix of speakers and more representation from, for example, directors of Indian scientific institutions. Unofficially, it was known that the French speakers had come prepared to speak to children and the actual audience was quite the contrary. Participants at the seminar felt that there was a gnawing gap in communication among scientists, social scientists and the public at large. It may be time for India to pay greater heed to bridging this gap by establishing a mechanism for smooth, two-way transmission. This should ensure a ‘single window’ system where, together with dissemination of factual information, the toils of scientific research, both basic and applied, reached the unaware

and, for those shouting from the rooftops about the irrelevance of type of research being done, a chance to air their views. Perhaps, also creating a special breed of communicators who could keep this transmission error-free, while communicating the essence effectively to policy makers. A new transparent approach is necessary for the challenges we face. In a national context, the public understanding of science and also scientists’ understanding of what people need from science are the crux, if science has to move forward with society’s support and goodwill.

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Phonons in condensed materials*

The International Conference on ‘Phonons in Condensed Materials’ was the fourth in a series of conferences held in India during the past three decades or so. Nineteen invited talks and 52 contributed papers were presented, among which 45 were in the form of posters. Several theoretical and experimental aspects related to phonon physics such as phonon dispersion, neutron scattering, vibrational spectroscopy, anharmonicity, thermal properties, surface phonons, phase transitions and phonons in superconducting, nanostructured, superconducting, and disordered materials were covered in the conference. R. Chidambaram (Principal Scientific Advisor to the Government of India) gave the keynote address at the inaugural function at which Bhai Mahavir, the Governor of Madhya Pradesh, was the Chief Guest.

S. L. Chaplot [Bhabha Atomic Research Centre (BARC)] gave an over-

view of various lattice dynamics and molecular dynamics calculation methods. He also presented phonon dispersion curves and density of states, and compared the results with the experimental data in a variety of systems such as minerals, high-temperature superconductors and negative thermal expansion materials. The phonons in the negative thermal expansion materials were also discussed by R. Mittal (BARC) and T. R. Ravindran [Indira Gandhi Centre for Atomic Research (ICGAR)]. Mittal compared the density of states in zirconium tungstate and hafnium tungstate and presented the Gruneisen parameters from high-pressure neutron scattering experiments, whereas Ravindran identified the phonons of large anharmonicities in zirconium tungstate from analysis of temperature-dependence of phonon frequencies. Phonon dispersion curves of rare-earth chalcogenides were presented by P. K. Jha (M.S. University, Baroda). His results suggest that the mixed-valence state arises from the hybridization of f- and d-electrons. R. K. Singh (M.P. Bhoj (Open) University) outlined the significance of the three-body potential formalism for understanding the vibrational properties, elastic, defect and mixed crystal proper-

ties and the high-pressure phase transitions. He also discussed phonons in superconducting and orientationally disordered materials. *Ab initio* methods for the calculation of electronic band-structure and phonon dispersion were discussed by B. K. Godwal (BARC). The method uses *ab initio* pseudopotentials in the framework of density-functional theory. He also presented results on MgB₂. Subrata Ghose (University of Washington, Seattle, USA) discussed the nature of dispersion curves of soft-phonons associated with phase transitions in several minerals such as anorthite and crysotobalite. He also provided evidence of coexistence of phases and fluctuations near the transition temperature. Narayani Chowdhury (BARC) discussed the nature of dynamical behaviour of several minerals at high-pressure using molecular dynamics simulations, and discussed their stability in the context of the earth’s interior. The effect of anharmonicity on the thermal expansion was outlined by V. K. Jindal (Punjab University, Chandigarh). The technique of quasi-elastic neutron scattering was described by R. Mukhopadhyay (BARC), giving several examples of translational and rotational diffusion of molecules in different hosts/

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environments, including porous media. He also discussed the melting of two-dimensional array of gold nanoparticles probed from the dynamics of attached alkyl chains.

Phonons in nanocrystalline materials were discussed in several talks. P. Entel (Gerhard-Mercator University, Germany) described the embedded-atom method for obtaining the vibrational properties of nanoparticles and showed that there is an increase in the density of states at low energies due to atoms at the surfaces and grain boundaries. The effect of optical phonon confinement on the Raman spectra was discussed by A. K. Arora (IGCAR). The broadening and shift of Raman lines were shown to be related to the width of the phonon dispersion curve. The vibrational spectrum of the surrounding medium was argued to determine the nature of the phonon confinement. A. Ingale (Centre for Advanced Technology, Indore) discussed the technique of impulsive stimulated Raman scattering and also gave evidence for the presence of surface phonons in the Raman spectrum of quantum dots. G. P. Srivastava (Exeter University, UK) described the methods for calculating frequencies of surface phonons using *ab initio* pseudopotentials and adiabatic bond-charge model. He also showed the evidence of dissociation of adsorbed ammonia molecules on silicon surface from vibrational spectroscopy. In addition, an empirical rule for the non-crossing of longitudinal- and transverse-optic branches was also mentioned. O. Pages (Institut de Physique, Metz, France) presented Raman results on zinc-beryllium chalcogenide mixed crystals and found more modes than expected for a two-mode behaviour. He assigned the additional modes to Be-rich (hard-like) and zinc-rich (soft-like) percolating bonds in the mixed crystals. There were two talks on superconducting materials. L. Pintschovius (Forschungszentrum, Karlsruhe, Germany) discussed the effect

of alloying on the softening of phonon dispersion curves in $\text{La}_2\text{SrCuO}_4$ and $\text{YBa}_2\text{Cu}_3\text{O}_7$ superconductors. These phonon anomalies were argued to lead to charge-strip order. He pointed out that several related issues are yet to be understood. C. S. Sunder (IGCAR) presented infrared spectroscopic results on MgB_2 and showed that the E_{2g} mode at 560 cm^{-1} exhibits large anharmonicity and also large electron-phonon coupling. He also presented results on LiBC and other rare-earth substituted superconductors. In addition, *d*-wave pairing mechanism was discussed by D. Varshney (D. A. University, Indore).

There were several talks, which described new techniques to study phonons or vibrational behaviour of novel macromolecular systems. B. V. R. Tata (IGCAR) discussed the nature of phonon dispersion curves of colloidal crystals and showed that these modes are overdamped due to friction of the fluid medium. A novel technique to study the surface acoustic waves in thin films using pulsed laser heating was described by J. Philip (Cochin University of Science and Technology). A foil detector is used for the detection of surface waves. He also presented an analysis to obtain the dispersion of these waves. P. Sen (Jawaharlal Nehru University, New Delhi) presented unambiguous evidence of phonon-assisted nonlinear energy transport in silicon lattice during heavy ion irradiation. This was argued to be soliton-like transport of energy from one point to another. Ajay Gupta (IUC for DAE Facilities, Indore) described a new technique to obtain partial vibrational density and states of iron in crystalline and amorphous environment. This inelastic nuclear resonance scattering makes use of the 14.4 keV transition of ^{57}Fe .

The poster papers were mainly related to lattice dynamical calculations, electron-phonon interaction, superconductivity, resistivity and thermodynamic properties of a wide variety of materials.

R. Chidambaram (Chairman, Technology Information, Forecasting and Assessment Council of Department of Science and Technology, Government of India) delivered an Evening Lecture at the Conference entitled 'Nuclear Energy to Rural Development'. He traced the development of nuclear energy in India in its varied aspects, including nuclear power and nuclear science, and how they reach the rural masses, from nuclear electricity to Dai Kits sterilized by radiation, for the overall betterment of life among the rural community. In the context of rural development, he pointed out that the generation of employment in the areas of food processing, farm production and other related industrial activities has to be promoted. Chidambaram referred to several important questions related to improvement of the quality of rural products and also how to downsize equipment to cater to the small cooperative sector, while maintaining quality and economic competitiveness, etc. He also stressed that the application of science to rural development has to include the application of high technology, whether it is human or plant genomics or advanced materials or even extension of established scientific and technological techniques through proper management practices. He also coined a new phrase 'coherent synergy principle' and elaborated how this would make effective rural development.

The proceedings of the conference will soon be brought out by Allied Publishers, New Delhi.

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