These statistics are cause for concern. If these trends continue, India's place in the world of science and its ability to use its technological strength to produce national wealth and compete globally will be greatly compromised.

1 Braun, T., Glanzel, W., Maczelka, H. and Schubert, A., *Scientometrics*, 1994, **29**, 299–334

2 Braun, T., Glanzel, W., Maczelka, H. and Schubert, A., *Scientometrics*, 1994, **31**, 3–30

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On *Current Science*

I would like to share and partly agree with the views of M. S. Hegde published on pp. 480–487 (*Curr. Sci.*, **68**, 10 March 1995) regarding the present trend of publications in *Current Science*. I had earlier thought that the format was intended to develop on the patterns of *Nature* and *Science*. In the recent years, however, a sizeable section of each issue has tended to become a science magazine, little better than *Science Reporter*. For instance, the article 'New roles for RNA' published under Research News section on pp. 488–490. (10 March 1995) is no more than textbook material, which should not find a place in a journal like *Current Science*. Although *Current Science* is serving a useful purpose of developing awareness about the most recent developments by publishing good review articles, it is not doing so well in publication of many full papers containing original research, as done in *Nature* and *Science*.

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The purpose of Research News is to highlight recent research for a wide audience. The quality and number of original research papers we publish in each issue is a fair reflection of submissions received by the journal, which pass the process of peer review.

– Editors

NEWS

Report on DAE Solid-State Physics Symposium, 1994

The 37th Solid-State Physics Symposium, 1994, was held at the University of Rajasthan, Jaipur, during 27–31 December 1994. More than 800 contributed papers and about 35 Ph D theses abstracts had been received by the Symposium Secretariat. After screening, 485 papers and 34 theses were accepted for presentation at the Symposium. Nearly 375 participants attended the meeting. The following gives a brief summary of the proceedings of the Symposium, except for a few invited talks which I could not attend.

In his presidential remarks at the inauguration of the Symposium, R. Chidambaram, Chairman AEC, mentioned that the Symposium has always served as a source for the beginning of a new science in the country, as it brings out new discoveries, new spin-offs, new applications, etc., that have taken place in India and elsewhere. He emphasized the importance of design and development of experimental facilities in the country and cautioned against total reliance on imported equipment. He said that one can be rest assured of obtaining obsolete technology if we are looking for import of proven technology. He underlined the need to go for certain amount of risks to innovate and develop new techniques and technologies even if not proven. He suggested that we should maximize optimally and synergetically the scientific interactions through the national laboratory system and the university system. He said that we should examine where the strengths of condensed-matter research lie so that one can mesh with industrial requirements of the country. Referring to the 'importance of science' – in Peter Medawar's words – he suggested that a considerable part of our efforts should be recognized as 'important science'.

R. N. Singh, the Vice-Chancellor of Rajasthan University, inaugurated the Symposium. He made several interesting remarks concerning the need for enhancing the work in applied areas. He lamented that there are no links at all between universities and industries, 'universities' to be interpreted as all the departments of solid-state physics, wherever they exist. Profit maximization being the end goal of business houses, he said that if one were to seek support from the industry for research, one has to demonstrate that our efforts lead in substantial manner to profit to the industry.

The first invited talk, by Nagarajan (TIFR), dealt with the excitement of the discovery of a new class of high-T_c materials, namely, quaternary rare-earth borocarbide family, at TIFR. There has been intense flurry of activity in the world all over on these materials since then. It is expected that these materials may be more amenable to processing for high-T_c superconducting applications. An 'index of excitement' to which he referred to was the large number of publications – nearly 100 papers – within a year of setting up a 'mini high-T_c race'.

Budhani (IIT, Kanpur) talked about 'vortex localization in high-T_c superconductors' and dealt with ways and means of reducing vortex creep in these materials by creation of columnar defects which are amorphous in nature. These defects are created by high-energy (nearly 250 MeV) heavy-ion (for example, silver ions) irradiation. In the context of the availability of heavy-ion accelerators in the country, this is an area in which there is scope for carrying out developmental work on high-T_c materials. The talk dealt with the various aspects of Bose-glass transition to understand the underlying mechanism of reducing vortex creep.

The seminar on materials processing for applications was coordinated by V. C. Sahni (BARC) and the one on

diamond films by Dua (BARC), on semiconductor films by S. K. Gupta (BARC) and on development of semiconductor devices for advanced applications by B. K. Sharma (SSPL). Dua has used high-temperature chemical vapour deposition techniques to develop diamond films in various forms like tubes, coils and thin films, as well as to coat tool tips with diamond. He discussed the methods of characterization of the material, especially by laser Raman technique. The diamond-coated tools have been three times more wear-resistant than the conventional hardened tools. He stated that beyond the silicon age, one is stepping into the so-called 'diamond age' for various applications. The talk on semiconductor devices by Sharma dealt with details of technological efforts being made at SSPL with regard to mercury–cadmium telluride preparation by liquid epitaxy, molecular epitaxy and other techniques. Sharma discussed the details of fabrication of one- and two-dimensional IR sensor arrays The talk showed the extent of quality and effort needed in these developmental activities and how one has to strive hard to achieve end-goals in time-bound programmes.

The talk by Roger Cowley (Oxford University, UK) dealt with magnetic multilayers, which are important for applications in various devices, especially in magnetic sensors, magnetic pick-ups, etc. He discussed in detail the behaviour of rare-earth multilayers in systems like AgCuY and FeCoHo from the viewpoint of magnetic structure, as derived from neutron diffraction. Coherence length derived from the width of magnetic Bragg peaks was shown to be nearly 1000 Å. From a detailed analysis of the data he showed that the spin turn angle continues through the nonmagnetic layers also in AgCuY. He concluded that one should consider the band structure of the entire superlattice and not just that of the individual bulk layers for understanding the magnetic behaviour of these systems. He stated that the nature of interaction is not given by $(s_i \cdot s_j)$ in RKKY theory.

The next talk, by Krishnan (Baleveau, France), related to multilayered materials for high-density magnetooptic storage devices He stated that rare-earth-based alloy films (like TbFeCo) which are amorphous and posses continuous solid-solution structure can be candidate materials for magnetooptic storage devices as they have a strong magnetic anisotropy. It is quite likely that, as further miniaturization of devices takes place, rare-earth-based thin films would be replaced by Co/Pt, Co/Pd films with layer dimensions of the order of 5–10 Å. He also discussed $Ni_{1-x}Co_x/Pt$ multilayers; on the basis of properties studied so far, they are considered potential candidates for future storage devices.

Disordered magnetic systems are the most studied systems amongst all disordered systems. Paulose (TIFR) in his talk 'Reentrant magnetism in metallic glasses' discussed the origin of spin glass behaviour below a certain critical concentration in systems like M_xN_{1-x}. Well above this critical concentration, ferromagnetism may be the order. He said that in the intermediate region the behaviour is quite complex. Paulose discussed the details of measurements on metallic glasses carried out at TIFR and discussed a number of phase diagrams for various compositions of Fe-based glassy materials, derived from a variety of magnetization measurements like AC susceptibility, hyperfine field measurements, etc. He raised a query as to whether the reentrant phase is inevitable in these materials. He also brought out some aspects of spin glass transitions and their relation to coercivity increase, and left the question as to which is causing which phenomenon unanswered. He ended his talk by stating that reentrant magnets should be considered as an independent class of materials like paramagnetic, ferromagnetic or antiferromagnetic materials During discussions it was pointed out that a lot more work needs to be carried out in these systems, e.g. specific heat measurements, nature of magnetic excitations, and detailed structural aspects.

Anjali Krishnamoorthy's (Jaipur) talk 'relaxation in fine-particle magnetic systems' related to magnetic properties of small particles, a subject which has been of interest over the last forty years. Renewed interest has arisen because of the efforts to explain the spin glass behaviour in these systems on the basis of superparamagnetism. Depending upon the size of the particles, there is a competition between barrier energy for flipping and thermal energy leading to various states like stable magnetic state or superparamagnetic state, etc. Reviewing the published literature from Dorman and others, she showed that there seems to be a scaling behaviour with respect to the volume of the particles, with dipole-type interactions involved. Interparticle interactions, concentration dependence and field dependence all exhibit spin-glass-like behaviour

One of the highlights of the symposium was the evening lecture by P. K. Iyengar, Member AEC, dealing with the early days of neutron scattering and his association with the activities of that period at Chalk River and later in India. Neutron scattering techniques have become universal techniques irrespective of institutions, facilities, etc. He covered the historical aspects of work referring to Rainwater, Fermi, Wollan and Shull, and others. Later he traced the developments in inelastic neutron scattering at Brookhaven by Don Hughes and others and by Brockhouse at Chalk River on various materials like Al, V, Ge, etc. He also referred to the results of the early neutron diffraction studies in Trombay on various systems.

K. B. Garg's (Jaipur) talk 'Natural and fake gem stones' related to an account of their initial forays in the field on characterization of gems. He referred to efforts to enhance the commercially valuable characteristics of gems by various treatments, to inadequacy of understanding the enhancement and to the problem of the so-called new gems, which are a mixture of sillimanite with feldspar. Advanced techniques like XRD, STM and atomic force microscopy have been used by the Jaipur group for analysing the quality of gems. He stated that there is a need for planned characterization activities to be able to distinguish fake (synthetic) from true (natural) gems and also to decipher whether the enhancements were everlasting or transient.

Properties like specificity, drug binding, etc., of proteins are related to the three-dimensional structure of proteins. K. K. Kannan (BARC) in his talk 'Advances in crystallographic techniques' dealt with various methods of protein crystallization, emphasizing the fact that protein crystals could be much more expensive than natural gems that Garg referred to earlier He discussed the various aspects of cryoelectron diffraction, image intensifiers with charge-

coupled devices, reusable image plates, direct X-ray detection using CCD cameras, which are some of the innovative devices that have been introduced in macromolecular crystallography during the past 10 years He dealt with some utilities like rotation and Weissenberg cameras which have made a comeback as computer technology and detection devices have made large-scale improvements in collecting large amounts of data. Kannan's talk was relevant in the context of utilization of INDUS-II synchrotron, which may come on stream at Indore in about five years time. He also referred to the National Facility for Macromolecular Crystallography, which has just been established at BARC in this context. This facility helps researchers from many institutions to come to BARC to synthesize macromolecules, crystallize them and take diffraction patterns by using rotating-anode generator and image plates and also analyse the data using the computer software and graphic support available at BARC.

There were a few talks concerning first-principle calculations of the properties of materials. The calculations aim at obtaining the total energy of the electronic ground state for several ionic configurations and arrive at the structure that corresponds to the minimum energy. With the availability of parallel processors in the country, based on density functional theory, several studies have now been carried out in simple systems.

R. S. Rao (BARC) discussed some of the details of this approach and illustrated specific examples from their own study: (i) crystal approximant of a quasicrystal; (ii) $AuIn_2$ alloy to explain thermoelectric power anomaly as a function of pressure; (iii) behaviour of high-T_c borocarbides at high pressures, and so on.

The talk on scaling behaviour of nonlinear conduction by Bardhan (IITK) dealt essentially with disordered amorphous systems like binary mixtures of conductors, glasses, conducting polymers, etc.

The talk by R. C. Desai (Toronto University, Canada) dealt with 'Pattern formation in laser-induced melting', in which he referred to the fact that nature is full of labyrinth of patterns, be they pertaining to a zebra or a binary liquid mixture; such patterns are ubiquitous. Some of these patterns are circular in topology and some cellular. These patterns span microscopic to macroscopic dimensions. By application of external fields, in certain systems one can go from one type of topology to another. So, one is interested in the kinetics of pattern formation. Desai and co-workers have carried out experiments in which 1 μm thick silicon is deposited on a sapphire base of 500 μm and laser light from Nd-Yag is shone on this system. Depending upon the intensity of the laser beam, one can have coexisting solid–liquid semiconducting film created on the substrate. These patterns are occasionally ordered and occasionally disordered. In ordered patterns, periodicity is that of the 10.6 μm laser beam. When the laser intensity is small, the pattern breaks down. The ordered pattern is understood on the basis of electrodynamics. In order to explain these interesting phenomena, which are non-equilibrium in character, Desai discussed the role of the energy of interfaces, which gives the interfacial contribution to the free energy, and of superheating of the solid phase and undercooling of the liquid region, which gives the bulk contribution. Similar patterns are seen in ferrofluids, co-block polymers, etc. One aim of the study is to understand the higher reflectivity of the melt, which is sufficient to explain the observed pattern. Model-building exercise to explain these is the most interesting aspect of the study. Desai talked about order parameters $\phi(r, t)$, which is related to the existence of the solid or liquid phase, and $T(r, t)$ which is related to the temperature field. He discussed later the details of the thermal dynamics taking into account diffusion, heat production, energy input from lasers and energy output to heat sink Stability analysis is carried out under certain approximations of large latent heat. He demonstrated that the mechanism of higher reflectivity of the molten regions can lead to the observed patterns.

In the talk on amorphization, we learnt that high pressure is one of the means of amorphizing materials. However, unlike melt-quenched systems, pressure-quenched systems are not understood in terms of the underlying mechanisms. It is stated that amorphization occurs because of kinetic frustration and this happens in a variety of materials. Molecular dynamic studies have been carried out using MOLDY program of Chaplot to delineate the various properties of alpha quartz, showing clearly how atoms change their coordination. Effects of nonhydrostaticity have been examined but in this write-up one cannot discuss all the data that were presented.

The last day saw three invited talks, one by Apoorva G. Wagh (BARC) 'Why neutron acquires a pure geometric phase', dealing with intricate theoretical aspects associated with neutron interferometry – which I could not follow easily – and some of the recent experiments concerning the first demonstration of anticommutativity of the Pauli spin operator. The speaker had proposed this experiment and had recently taken part in the same at Missouri Research Reactor. The second talk, 'Phase jumps and discontinuities in the evolution of two-state systems', by Rajendra Bhandari (RRI), also related to interferometry. This talk covered a wide spectrum of topics like classical analogue of geometric phase, geometric phase lens and even cholestric liquid crystal The last talk of the Symposium was on molecular electronics, by Ratna S. Phadke (TIFR). Molecular electronics has been of interest for more than two decades and the talk gave a state-of-the-art review of the subject, which shows a lot of promise for the future.

One must compliment the young doctoral students who made presentations of their important findings through their theses presentations. In several presentations, I found that they were of a high professional calibre, as reflected by the thoroughness with which detailed investigations had been carried out Whether it was the magnetic properties of rare-earth compounds/alloys or the effect of nonstoichiometric oxygen distribution in oxide superconductors or positron annihilation spectroscopy in relation to nucleation and growth mechanism of bubbles in various materials or superconducting and magnetic properties of rare-earth borides, the works presented by these students encompassed important problems, the solution to which can give birth to very rich new physics. So, it is not only the evolution of the students into mature researchers which was evident but also

their important contributions in this process to real problems.

I must confess that I do not go through posters extensively – I have a phobia perhaps. However, during my rounds in the poster sessions, I found that a few studies lacked proper motivation; in one or two cases the theoretical analysis of the experimental data was not very transparent. But this is in the nature of the wide spectrum of contributions that we do receive in symposia. Hopefully, the quality will improve and we shall see better work in the future symposia. Obviously, I cannot comment on the content of specific posters because they are too many, and adequate time was not available to go through them in any depth. However, two posters which drew my attention were on (a) $Nb/Al_2O_3/Nb$ Josephson-junction-based development of 1 V level voltage standard, which is at par with international level having an uncertainty of 1 in 10^9 at NPL and (b) quaternary critical-point studies carried out at IISc.

The thesis 'Magnetic and 4f electronic quadruple anomalies in rare-earth compounds', by Indranil Das (TIFR), was adjudged as the Best Presented Thesis by a panel of judges consisting of Drs P. S. Goyal (BARC), B. K. Srivastava (Jaipur), K. K. Bardhan (SINP) and V. P. S. Awana (TIFR).

The invited talks will be published as a special issue of the *Indian Journal of Pure and Applied Physics* as was done last year.

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The 1994 Goldschmidt Conference, Edinburgh

The fourth V. M. Goldschmidt Conference, an international conference for the advancement of geochemistry, held at Edinburgh (Scotland, UK) from 28 August to 2 September 1994 was a grand and mammoth event organized by the European Association of Geochemistry (EAG) and the Department of Geology and Geophysics, University of Edinburgh. The supporting institutions of the conference, among others, included the Geochemical Society, American Geophysical Union (AGU), Mineralogical Society of Great Britain and Ireland, Geological Society of America (GSA) and the International Association of Geochemistry and Cosmochemistry (IAGC). The unusual richness and enormous diversity of the conference symposium themes, coupled with exceptionally incisive and evocative expositions by researchers of repute, made the Goldschmidt Conference a stupendous scientific success

The 15 major symposium themes, the total number of oral and poster presentations for each symposium, and the names of the conveners are listed below to highlight the current trends in modern geochemical research and the enviable popularity that some selected themes continue to enjoy: 1. Theoretical Geochemistry – 12 (G. D. Price & A C. Lasaga); 2. Experimental Geochemistry – 60 (B J. Wood & T. J. Falloon), 3. Geochemical Techniques and Applications – 4 (posters only); 4 Weathering and Erosion, Deposition and Diagenesis – 73 (M. Krom, R. Raiswell & J. I. Drever), 5 Groundwater Chemistry and Palaeohydrology – 26 (A. H. Bath & F. Philips), 6 Waste Containment and Pollutant Transport – 26 (P. J. Hooker & A. C. M. Bourg); 7. Ocean Composition and Fluxes during the Quaternary – 19 (G. B. Shimmield & T. Pedersen), 8. Ocean Palaeochemistry and the Evolution of Ocean Basins –20 (H. Elderfield, J. Veizer & M. Kastner); 9. Modern Submarine Hydrothermal Processes – 17 (H. Elderfield & S. Humphris); 10. Mechanisms of Isotopic and Chemical Communication in Crust and Mantle Rocks – 22 (C. M. Graham & D. R. Cole), 11. Partitioning of Elements – 26 (P. Beattie & J. Brenan); 12. Dehydration, Partial Melting and Fluid Distribution in the Crust – 44 (S. L. Harley, B. J. Hensen & M. J. Bickle); 13. Magma Generation Processes – 84 (R. Ellam, E. M. Stolper & D. H. Green); 14. Mantle Development in Space and Time – 68 (A. Halliday & A. W. Hofmann), 15. Geochronometry and Thermal History – 21 (R. A. Cliff, S. Inger & J. R. Wijbrans).

The scope of some of these symposium themes was so vast that each one of them was further divided into more than 4 subheadings. For example, theme 14 (68 presentations) was treated under 8 subheadings: (a) experimental constraints on melting in the mantle; (b) source regions, extraction and evolution of basaltic melts; (c) mantle mineralogy and the transition zone; (d) large-scale mantle to terrestrial geochemistry; (e) rare gases; (f) mantle fluids and mantle metasomatism; (g) small-scale evidence of geochemical processes in mantle rocks and ultrabasic complexes; and (h) mafic–ultramafic rocks and complexes. Some of these subheadings overlap with those of theme 13 (84 presentations)

The established conveners of all the themes quite expectedly brought in an air of academic authority and touch of class, and it was no surprise that their presence imparted scientific dignity to the scholarly proceedings.

One of the major attractions of the Conference was the four UK Mineralogical Society plenary lectures and one IAGC Ingerson lecture delivered by internationally renowned luminaries on wide-ranging topics. These few lectures took place at convenient times, when there were no other lectures in any sessions, so as to facilitate all the delegates to hear the distinguished masters. They are listed below:

Applying MeV ion beam techniques to geochemical issues: cross-fertilizing nuclear physics and geosciences (J.-C. Petit, Commissariat à l'Energie Atomique, France)
The composition of the continental crust (K. H. Wedepohl, Gottingen University and Ingerson Distinguished Lecturer of IAGC)
Mantle plumes and other mail from the mantle (S. R Hart, Woods Hole Oceanographic Institution)
Isotopic and elemental tracers in calcium carbonate fossils (E. A. Boyle, Massachusetts Institute of Technology)
Degassing history of the Earth (R. K. O'Nions, University of Cambridge and EAG President).

These lectures were not merely superb state-of-the-art reports by outstanding experts; they clearly provide insight into the future directions of research and give a glimpse of the emerging challenges in frontier areas. These brilliant expositions,