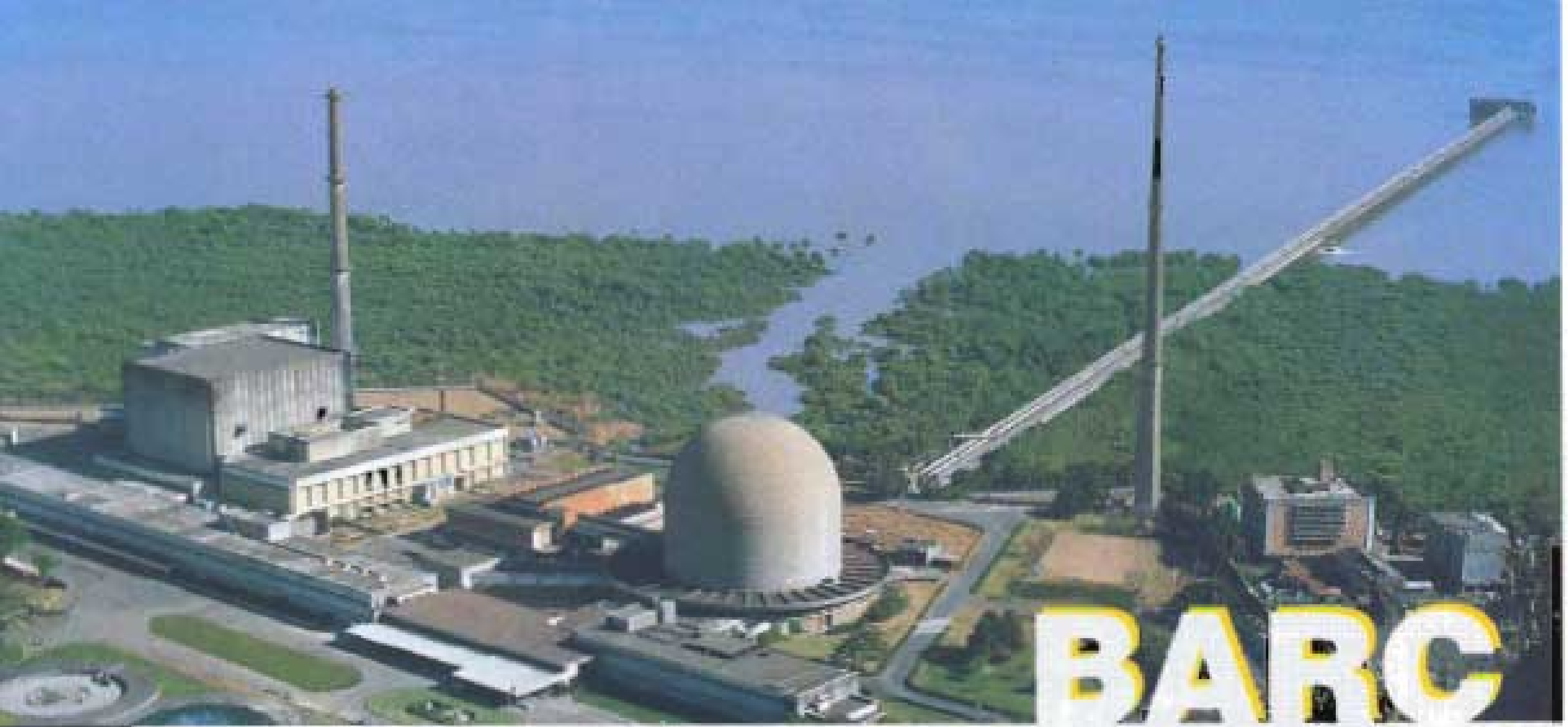

BARC NEWSLETTER

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Contents

DIAMOND COATINGS - TRENDS AND FUTURE

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Novel Materials & Structural Chemistry Division

Diamond needs no introduction. It is a precious gem and the discoveries of diamonds were made thousands of years ago in the diamond fields of Golconda in India. Terms like ' diamonds for ever ' and ' diamond- a girl's best friend' have been in vogue for quite sometime now. Chemically, it is just carbon – being one of its crystalline forms. It is endowed with extreme, unique and diverse properties and these can be seen as described in Table 1 to be always either a minima or maxima of the values for all the materials for any given property. Also, the combination of high thermal conductivity and high electrical resistivity is rather rare. All these excellent properties have given rise to its large application potential with high economic stakes and this forms the chief motivation for the advancement of diamond related science and technology. Diamond occurs in nature with its supply being limited, uncertain and far below the demand. This has fuelled efforts to synthesize it in the laboratory.

First success for synthesization was achieved using the high pressure (~ 100 kbar) high temperature (~1400°C) HPHT method[2]. The method is unable to deposit diamond thin films and coatings, which forms more useful configuration for some important applications. For the purpose, several chemical vapour deposition methods have been developed recently. Herein, a gas phase chemical reaction occurs above the substrate surface and is carried out at nearly atmospheric or sub-atmospheric pressure, the substrate temperature being ~1000°C. Under these normally used conditions, although diamond is thermodynamically unstable, kinetics

Table 1 : Various diverse properties exhibited by diamond

Property	Value	Remarks
Atom number density	$1.77 \times 10^{23}/cm^2$	Highest of any material at terrestrial pressure
Hardness	12,000-15,000 kg/mm^2 (Vickers)	Highest* intrinsic
Elastic modules	1.2×10^{12} $N.m^2$	Highest
Room temp. thermal conductivity	20 W/cm K	Approx. 4 times () rather rare Copper or () combination Silver
Electricity resistivity	~ 10^{13} Ω cm	High
Band gap	5.45 eV	High
Dielectric Strength	1×10^7 V/cm.	Exceedingly high
Charge carrier velocity	1×10^7 cm/sec for holes 2×10^7 cm/sec for electrons	Unsurpassed
Radiation resistance	Radiation hard	Extremely low capture cross Section for neutrons
Thermal co-efficient of expansion	0.8×10^4 at 300 K	Lower than even invar
Co-efficient of friction	0.1 in air	Low
Thermal shock resistance	-	Good
Sound propagation velocity	18.2 km/sec.	High
Optical transmission	Wide range from λ=0.22-2.5 & < 6μm	
Chemical inertness	Superior. Resistant to all acids, bases and solvents at room temperature	

*Recently, nano-composite coatings of nc-Ti N/a-Si N_1 with extrinsic hardness at least as high as that of the hardest diamond have been reported[1].

and presence of atomic hydrogen has been made to overtake thermodynamics.

The synthesis of diamond obviously requires a source of carbon. Many carbonaceous gases such as hydrocarbons, alcohols, ketones, carbon oxides, carbon halides etc., have been found to be suitable source gases[3] . Carbon containing precursor molecules may be activated by thermal means (e.g. hot filament, combustion flame) or by plasma (D.C., R.F. or microwave). The decomposed product is made to form a film on the substrate and the formation of non-diamond carbon is prevented by the presence of a selective etchant such as atomic hydrogen which etches away graphite ~100 times faster than diamond. Atomic hydrogen plays other important roles as well[4].

High pressure (pressure ~ one atmosphere) methods normally give higher deposition rates but the area that can be coated becomes smaller. In chemical vapour deposition of diamond, the linear growth rate has been found to increase linearly with the temperature of CVD gas phase[5]. Hot filament chemical vapour deposition (HFCVD), plasma assisted chemical vapour deposition, plasma jet methods and combustion flame methods are amongst the popular techniques being used presently[6] . The choice of the method in actual practice depends on the requirement of the final product. Detailed comparision of the methods, together with their suitable application areas, can be found elsewhere[7].

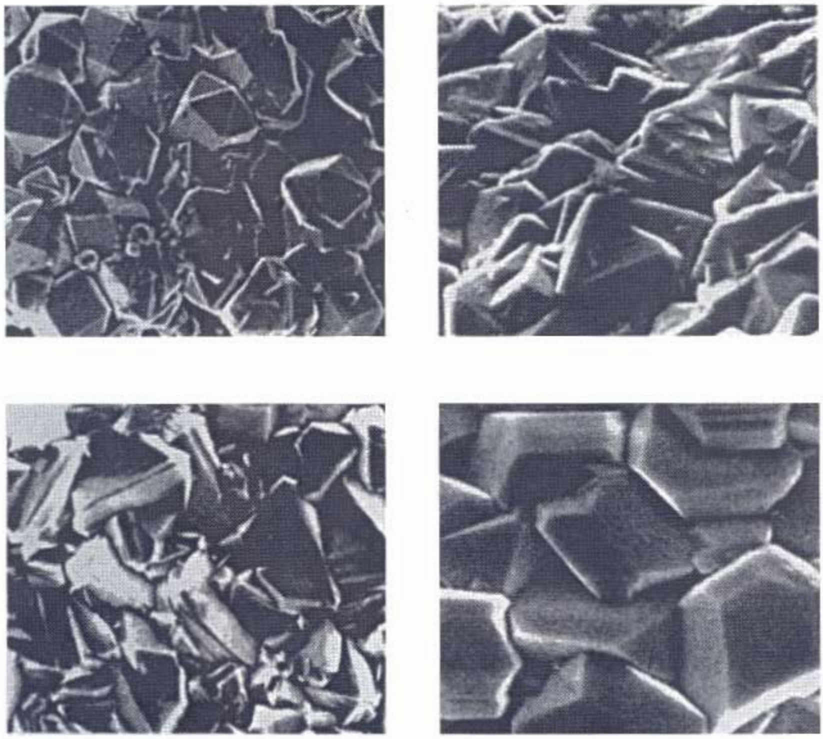

Fig.1 : Scanning electron micrographs of some of the films prepared in the laboratory.

HFCVD and oxy-acetylene flame facilities have been set up in the laboratory to deposit unambiguously characterised continuous, multiplayer, polycrystalline coatings on a host of substrates such as silicon, molybdenum, tantalum, tungsten, zirconium, copper, gold, different type of steels, alumina, tungsten carbide, phosphor bronze, etc. Adhesion, however, differs from substrate to substrate. Neverthless adequate adhesion has been achieved on silicon, molybdenum, tungsten carbide and phosphor bronze alloy. X-ray diffraction, scanning electron microscopy, Raman spectroscopy and electron energy loss spectroscopy have normally been used for characterisation of the diamond films.

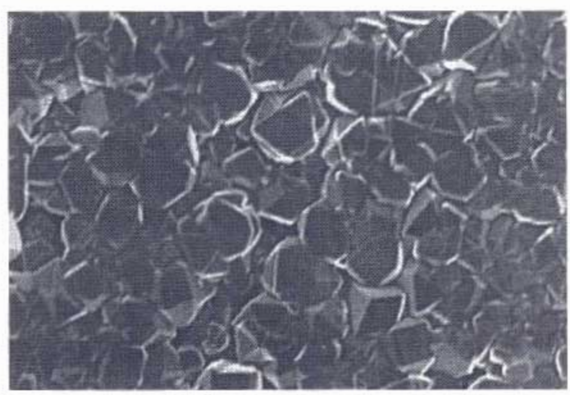

Fig.2 (a)

Surface morphology depends on the deposition parameters used and Fig.1 depicts scanning electron micrographs of some of the films prepared in the laboratory. Fig. 2 , on the other hand, unambiguously shows the films to be diamond. Innovative modification[8] of 'jet-flow' along with high flow rates of input gaseous mixture in HFCVD technique has been introduced and this has enabled us to increase the filament to substrate distance and coat diamond on three dimensional comparatively large sized odd shaped substrates, both inside as well as outside. Using this modified technique, methodology has been developed, to form phase pure exotic diamond shapes, such as self supporting diamond tube (Fig. 3a), self-supporting

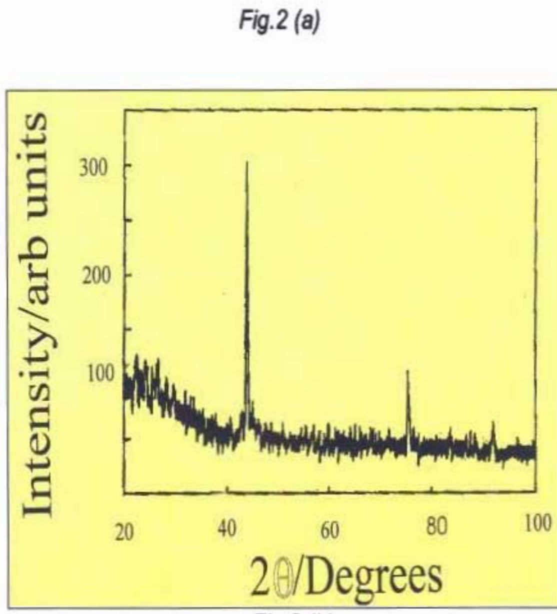

Fig.2 (b)

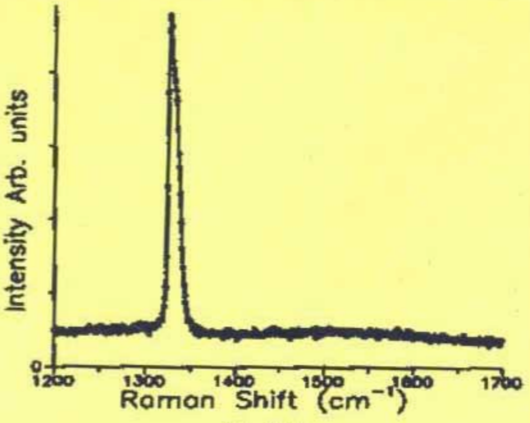

Fig.2 (c)

Fig.2 : Unambiguous characterisation of diamond films: (a) its scanning electron micrograph, (b) its X-ray diffraction pattern, and (c) its laser Raman spectrum.

supporting hollow diamond helix (Fig. 3b) and self-supporting diamond sieve (Fig. 3c). These shapes, endowed with extreme and exceptional diamond properties, are expected to find several high technological applications[9]. Diamond, an insulator, can be doped so as to form a semiconductor. Diamond thin film electronic devices are a new generation of devices which can operate at high temperatures (~ 500 ° C) in very severe chemical environment and are radiation resistant. MIS structures could be fabricated using polycrystalline diamond film as an insulator, Si (100) as semiconductor and titanium as metal contact. These structures are stable when exposed to 1 MRad of γ-rays and up to a temperature of 200° C[10] . The diamond coated cutter (Fig. 4) made in BARC efficiently cuts glass slides and silicon wafers, and the tube cutter wheel shows improved performance. Also, cobalt cemented tungsten carbide tool inserts of different types, when coated with diamond, show under actual production conditions (i) 100-fold increase in tool life for high speed machining (cutting speed = 800 m/min., feed = 0.15 mm/rev., depth of cut = 1.5 mm) of LM 24 aluminium alloy wheels and give good surface finish to the job, and (ii) an increase of 25 % in tool life for high speed machining (cutting speed = 80 m /min., feed = 0.15 mm/rev., depth of cut = 1 mm on both outer and inner diameter) of cast iron piston ring

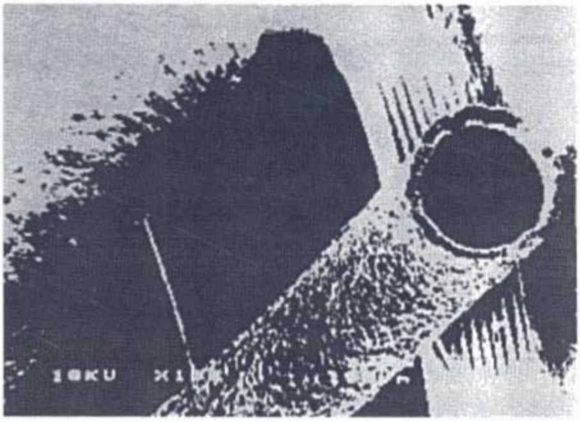

Fig.3(a)

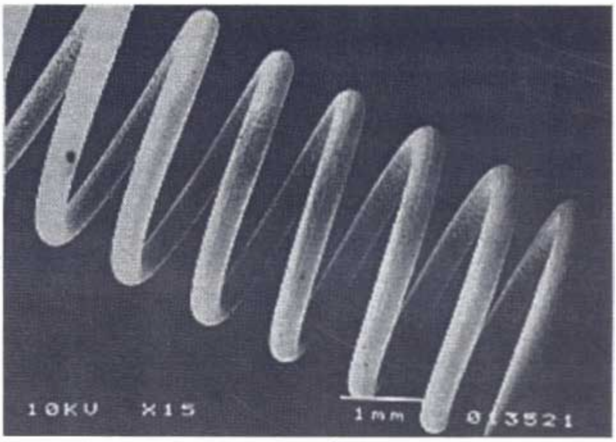

Fig.3(b)

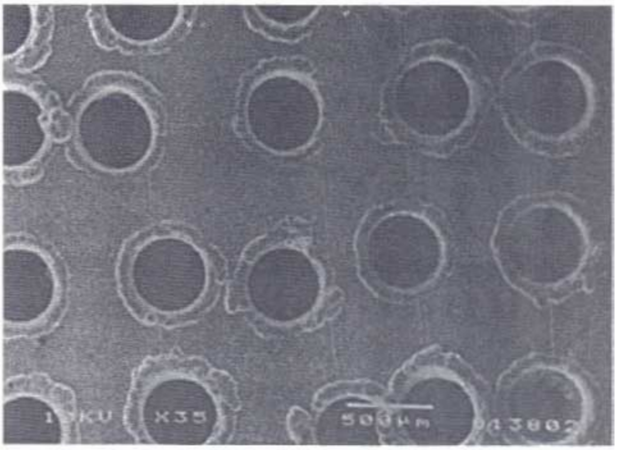

Fig.3 (c)

Fig.3 : Phase pure exotic diamond shapes prepared in the laboratory : (a) self-supporting diamond tube, (b) self-supporting hollow diamond helix, and (c)self-supporting diamond sieve.

stacks. Successful coating could also be done on phosphor bronze components which were to be subjected to very high disruptive mechanical forces and needed to be tribologically compatible as well. Figures 5,6 & 7 show the range of products coated by us with diamond.

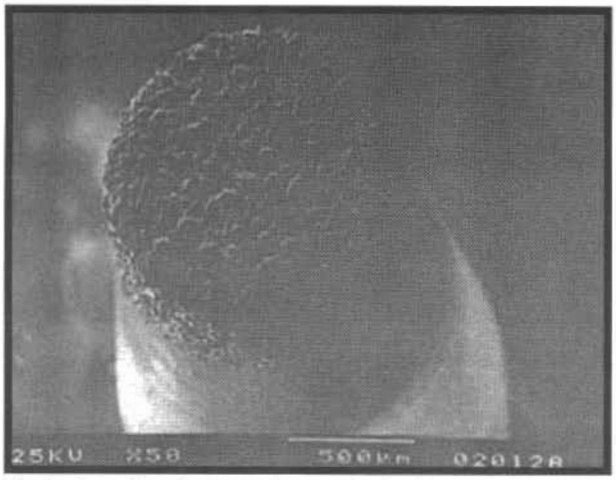

Fig.4 : Scanning electron micrograph of a diamond coated cutter prepared in the laboratory.

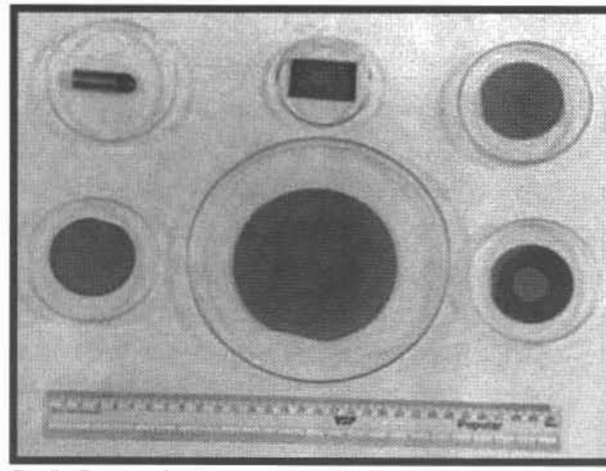

Fig.5 : Range of products , coated with diamond : silicon wafers up to four inch diameter and inside of molybdenum tube (9 mm inner diameter and 40 mm long).

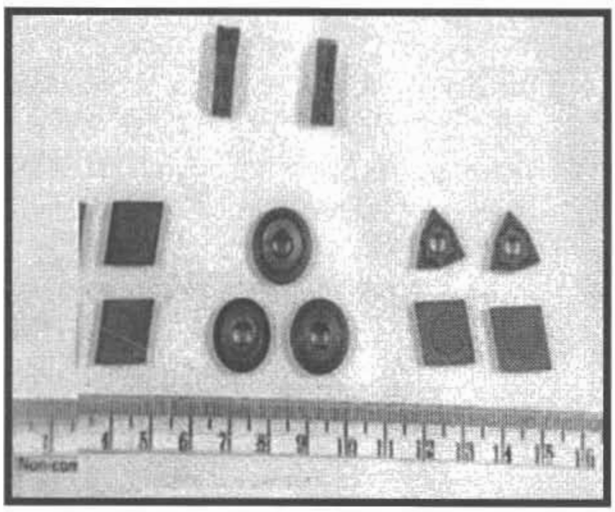

Fig.6 : Diamond coated WC-tool bits and molybdenum tube cutter wheels.

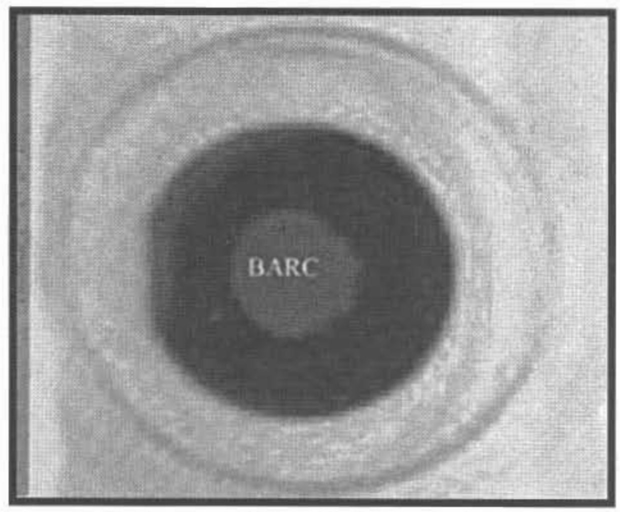

Fig.7 : One inch diameter diamond window.

The field of diamond thin films is very broad and we could focus our attention to only a miniscule portion of it. There are many other important applications as well and these are based on some of its specific properties or their appropriate combinations. Presently, IR windows for missiles and tactical aircrafts, periscope windows, diamond transistors and integrated circuits, medical implants etc. are low volume, high value added products. X-ray windows, X-ray masks, heat sinks for electronics, tribological and corrosion resistant coatings are medium volume medium value-added products while diamond coated cemented carbide tools, diamond capacitors, and magnetic hard disc coatings come under high volume low value-added products. Windows, transparent to IR, X-rays, high power lasers and operating under severe conditions of temperature, pressure differential and reactivity, have become available. One such window used on the spacecraft Pioneer, while exploring the planet Venus, could successfully withstand the very severe environment comprising of 1% sulphuric acid, 450ºC temperature and ninty atmosphere pressure differential[11].

Presently it has become possible to give protective diamond coating to large area (8-10 inches diameter) infra red windows (particularly ZnS) which should allow it to better withstand aerodynamic heating and erosion by airborne sand or rain for aerospace use[12]. These are expected to find applications in IR imagers and sensors which are being increasingly used for military applications in fighter aircrafts, missiles, night warfare equipment, etc. Electronic applications , really speaking, are still to take off and are several years down the road. Thus ultrafast supercomputers, extremely rapid and compact communication systems and devices which can operate inside running jet engines and nuclear reactors are awaiting advances in diamond thin film research.

Coming to the status of the field, not much headway has been made at the national level, specifically with respect to the application point of view. On the other hand, at the international level, multinational giants, defence and space related organisations are pumping in enormous amount of funds in diamond related research and technology so as to become key players in this strong field. Most of the crucial innovations are closely guarded and proprietary in nature. Nonetheless, the research worldwide is directed towards growing better quality films, at higher rates, on to a larger area substrate, at lower temperatures and with as good a uniformity as possible. Simultaneously, efforts are being made to grow reasonably large, defect free, single crystal films for electronic applications. Presently, the substrates range from metals to semiconductors to insulators and from glasses to single crystals; the lower temperature limit has dropped from ~1000º C to ~ 100º C and deposition rates have increased to ~ 1µm/sec.

Some exciting developments have taken place in the field recently and these include innovative new methods. For this the reader is referred to our other publications[13]. Low pressure solid state source technique[14] and the novel pulsed multi laser technique[15] could become of major significance. Also, diamond coatings are expected to make so large an impact in near future that many people believe that future age will be known as 'diamond age' going chronologically from the 'stone age' to 'bronze age' to 'iron age' of the past and 'silicon age' of the present.

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A MOBILE RADIOLOGICAL LABORATORY FOR RAPID RESPONSE TO RADIATION EMERGENCIES

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and

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Introduction

To meet the increasing energy consumption, reliance on nuclear power is growing the world over. Its contribution to the total electricity produced is also expected to go up. Consequently, there is increased concern about the protection of the public and environment from dispersion of radioactivity beyond the sites, particularly after the reactor accident in Chernobyl in 1986.

Fig.1. Exterior view of the MRL

India has also embarked on the expansion of its nuclear power generation capacity. Though the focus is always on the prevention of any accidental releases of radioactivity from the Nuclear Power Plants (NPPs), regular environmental and radiological monitoring and preparedness to deal effectively with a radiation emergency in the public domain have been accorded a high priority. A network of Environmental Survey Laboratories (ESLs) has been established to serve this objective. To further strengthen the competence of ESLs, Internal Dosimetry Division of BARC has built a Mobile Radiological Laboratory (MRL) (Fig.1), which is indeed a compact ESL on wheels.

Objectives

1. The MRL is primarily for rapid deployment in the public domain in the event of a nuclear accident and/or nuclear weapon explosion for speedy compilation of environmental and radiological monitoring data in order to evolve and implement suitable remedial strategies.
2. The MRL is also equipped for routine radiation monitoring of an area of about 30 km radius around a NPP.
3. To generate base line data around a proposed nuclear site.
4. To investigate the site of any accident involving transport of radioactive materials.
5. Co-ordination with the aerial survey by collection of ground level monitoring data of the region.

In addition, the MRL can play a vital role in the public awareness program by screening relevant video films.

Description

MRL has been designed for a two-weeks' continuous outdoor operation. To minimise the impact of jerks and vibrations on the installed instruments/ equipment, it is built on a 10.70 m long air-suspension Bus-Chassis. The MRL is partitioned into four compartments, namely,

i) Driver Cabin (1.80m), ii) Counting Lab.(CL) Cabin (5.0m), iii) Whole Body Monitor (WBM) Cabin (1.80m), and iv) Utility Cabin. (2.10m)). The air-conditioning (A.C.) capacity of 7 refrigeration tons is adequate for operating the MRL up to 45°C ambient temperature. Normally, AC is restricted to the CL cabin, but if required it can be extended to WBM cabin by opening the sliding glass panel in the partition. During the field operation two diesel generators of 5.5 & 7 kW capacity provide the power. At the Head Quarters (HQ) and wherever available, 230V AC mains supply can be used for operating the MRL. The field operation is managed by a 5 member team including the driver. General utilities, for use by the field staff during field operation, are provided in the utility cabin. For restricting entry, the main and CL cabin doors have been provided respectively with audio and password entry system. The wider rear door for use during field monitoring operation has a folding ramp for convenience in climbing up/ down. A camera provides a continuous rear view to the operator for controlling the exit/ entry through this door.

Instrumentation

The instruments installed in the MRL (Fig. 2), include : Alpha, beta and gamma counting systems for identification of radionuclides and estimation of their concentrations in the air,

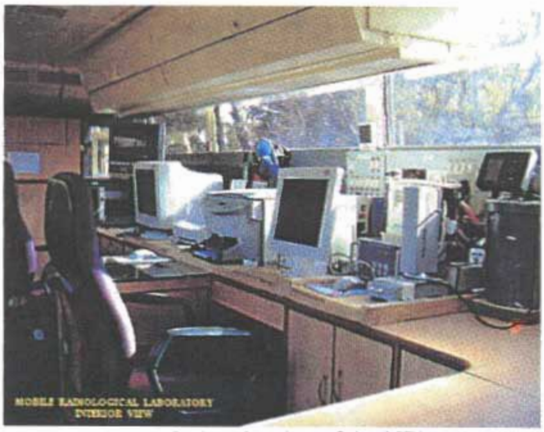

Fig. 2. interior view of the MRL

water, soil and vegetation; 'Gamma Tracer' for continuous environment dose rate recording; a variety of survey meters for measurement of radiation levels from μR to 1000R; personal dosimeters and protective equipment for MRL staff and the representative groups from the public; an automatic weather station mounted on a pneumatic telescopic mast for recording continuously the meteorological parameters; and a satellite-based global positioning system to continuously track and display the geographical location of the MRL.

Special Equipment

1. ***Shielded Chair - Whole Body Monitor (SC-WBM) :*** A specially designed chair type whole body monitor (Fig. 3) has been installed for the assessment of internal radioactive contamination of the human body, in particular, the thyroidal uptake of radioiodine. Its design concept is based on a high back chair. To give it

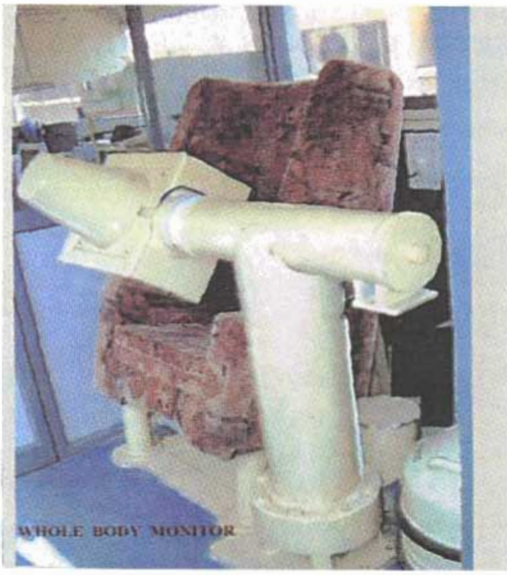

Fig. 3 Whole Body monitor

a curved shape and minimise the total weight, fine lead granules were filled in the hollow mild steel shells representing the seat and curved back. The chair shield is designed for thickness equivalent to 90 mm and 70 mm of lead for back and sides respectively. The chair is tilted backward by 15° to provide comfort to the subject and ease in getting in and out of it. The 300 kg detector shield, housing a 10.2 cm dia x 7.6 cm thick NaI(Tl) detector, is fixed to a horizontal arm which can be revolved to allow the subject in and out of the counting position and rotated to facilitate monitoring of specific body section. SC-WBM weighing about 2 tonnes is the heaviest equipment in the MRL and is, therefore, located on the rear axle of the vehicle.

2. ***In-Situ gamma spectrometry :*** In-situ gamma-ray spectrometry, using a HPGe or NaI(Tl) detector placed one meter above the ground, is an established method for identification of radionuclides and their concentration in/on the soil as well as for evaluation of dose rate due to radioactive contamination of the ground. For in-situ measurement, a 7.6 cm dia x 7.6 cm thick NaI(Tl) detector coupled to a Labspec is mounted on a tripod stand with its face at one meter above the ground. Labspec, a PM Tube Base, is a gamma spectrometry unit with 1K MCA. NaI(Tl) detector is preferred to HPGe because of likely non-availability of liquid nitrogen in far away places. A Target make Fieldspec, a compact hand held 1K MCA based gamma spectrometry unit with 2.5 cm dia x 5 cm thick NaI(Tl) detector is also used for qualitative and quantitative in-situ analysis.

3. ***Wind wane angle correction :*** The wind direction angle is measured relative to the geographical north. Therefore, while mounting the wind wane on the mast, its north and that of a magnetic compass fixed near the operator's seat are matched with the geographical north. However, during field operation, the vehicle is likely to be parked in any direction. The compass indicates the angle by which the wind wane is off geographical north. An electronic device has been developed to make the angle correction by appropriately modifying the wind wane output.

4. ***Diesel supply to the two Diesel Generators(DG) :*** Two Diesel Generators(7 kW & 5.5 kW) have been installed in the MRL for providing power during field operation. Both the DGs have individual fuel tanks of 8 litres capacity, sufficient for about four hours of continuous operation. However, since the DGs are located below the vehicle chassis, it is difficult to manually fill the fuel tanks. Therefore, arrangement has been made for direct fuel supply to the DGs fuel tanks from the vehicle fuel tank of 239 litres capacity. A suction pump installed near the vehicle fuel tank, pumps the diesel to the fuel tanks of DGs, which have been provided with an automatic fuel cut-off device to prevent overflow. For safety during the vehicle movement, this fuel supply line is blocked by a manually operated valve located near the vehicle fuel tank. The start and stop controls for operating the DGs have been installed in the WBM cabin.

5. ***Power distribution system :*** The power for operating the MRL is provided by 230V AC mains at the Head Quarters and wherever available or by the two diesel generators during field operation. Power is required mainly for instruments, and the three AirV air-conditioners. Depending on the requirement governed by the number of AirV units required for cooling, any one or both the DGs can be operated. A power distribution system has been installed in the WBM cabin to isolate each source of power to prevent any problem due to phase mismatch.

6. ***Status display of heavy adjustable equipment :*** To prevent the possibility of damage in case any of the items, namely, the detector shield arm of the SC-WBM, the heavy lids of the HPGe and NaI(Tl) detector shields, extended AWS mast, or lowered diesel generators, is not locked in safe position, a musical track runs and warns the operator if the vehicle engine is started.

MRL Operation

Two personal computers (PCs) and a laptop have been net-worked to provide a centralised facility for the management of data obtained from the various monitoring systems provided in the MRL. The data from the PC-operated gamma spectrometry systems, namely, HPGe & NaI(Tl) sample counting systems, in-situ measurement set-up with laptop and Whole Body Monitor, are acquired by operating the systems through the MCA add-on cards in the PC. However, the data from the systems having their own storage facility, e.g. gamma tracer, high volume air sampler, automatic weather station, alpha & beta counting systems, Fieldspec and most of the survey meters, are transferred through a RS232 interface to a PC. The processing, analysis and evaluation of the entire data are performed in the MRL and the results can be transmitted to the HQ.

Visit to TAPS

The road worthiness of the MRL on rough, bumpy and narrow roads was tested during its maiden visit to a village near the Tarapur plant site. During this visit, all the instruments were kept in operating condition on power supply derived from the diesel generator. This visit has demonstrated the usefulness of the MRL for the defined objectives.

Conclusion

Mobile radiological laboratories, designed and equipped for specific monitoring tasks, have come to play an important role in an off-site radiation emergency response. Our first MRL, details of which are reported here, has been developed specifically to cater to a wide range of environmental and radiological monitoring requirements around a Nuclear Facility. The expertise acquired in building the MRL will be valuable for designing the mobile laboratories for any specific monitoring application. For quality assurance purposes, it is proposed that the MRL will participate in the future international intercomparisons of the Mobile Radiological Laboratories.

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MEDIMEET 2003

The Medical Division of BARC hosted the 5th DAE doctors' conference 'MEDIMEET 2003' at Mumbai during February 7 to 9, 2003. The event was being held for the second time in BARC, after the 1st Medimeet was hosted in 1992. Since then, the conference is being held every two years at different DAE stations.

Dr Anil Kakodkar, Chairman, Atomic Energy Commission, inaugurating the Medimeet 2003 by lighting the lamp

The meet was inaugurated on the morning of February 7 by Dr.Anil Kakodkar, Chairman, AEC. He also released a souvenir on the occasion. Mr B. Bhattacharjee, Director, BARC, presided over the function and released the 1st issue of 'Pulse', the in-house newsletter brought out by the Medical Division, BARC. Dr V.K.Chaturvedi, Chairman & Managing Director, NPCIL, graced the occasion as guest of honour. Both Dr Anil Kakodkar and Mr B. Bhattacharjee stressed on the importance of health care services and the top priority position it enjoys in DAE. Hence, it was appropriate that excellence was pursued in the health care services just as in nuclear services and technology at BARC. This conference was one such opportunity to share knowledge, update skills and learn about new trends and technology.

Dr Anil Kakodkar, Chairman, AEC, addressing the gathering at the Medimeet 2003. Seen on the dais from left to right are : Dr J. Shankar, Associate Director, Medical Group, BARC, Dr V.K. Chaturvedi, CMD, NPCIL, Mr B. Bhattacharjee, Director, BARC, and Dr P.T.V. Nair, Head, Medical Division, BARC

The audience included, besides the 200 delegates, a galaxy of distinguished invitees from the DAE family and many senior past members of the Medical Division, who took time and effort to attend the conference. They were a source of encouragement to their junior colleagues.

Audience at the gathering of the Medimeet 2003

Mumbai, being in the forefront of health care, eminent doctors from the city, all stalwarts in their respective fields of medicine, were invited to share their vast knowledge and experience with the delegates.

Dr K. Ramamurthy, a noted physician and a teacher par excellence, gave the keynote address. He spoke about the practice of medicine in the past, the changes it has undergone to its present state and what the future is likely to be. A number of very important and relevant topics for the medical practitioners were discussed during the meet, such as acute coronary syndrome, hypertension, infectious diseases, treatment of HIV infections, management of Hepatitis B, interventional radiology, common ENT problems, PET scan vaccines, HRT, etc. The delegates had an opportunity to interact and discuss these with the respective experts in the field. There was a very relevant and thought - provoking panel discussion on Medical ethics in clinical practice.

The delegates also got a platform to present their respective work in the form of papers in the free scientific paper session. More than 40 free papers were presented during the three days of the conference. 16 papers were presented as posters at the venue. Besides this, they could also discuss their work informally with colleagues during the meet.

The event was managed with clinical efficiency and ended with an open forum where there was a free flow of ideas. A vote of thanks by Dr P.T.V. Nair, Head, Medical Division, was the concluding event of the Meet.

BARC TRANSFERS TECHNOLOGY OF TLD BADGE

BARC has transferred the technology for production of Thermo Luminescence Dosimeter (TLD) Badge on non-exclusive basis to M/s ANI Associates, Mumbai, on October 16, 2002.

TLD badge is used to provide a simple and accurate technique for personnel monitoring of radiation workers incurring exposure due to X-rays, gamma and beta radiation. This is done with the help of three TLD discs loaded in aluminium card. TLD badge is based upon the

At the conclusion of technology transfer agreement signing, seen in the photograph from left to right are : Mr A.K. Bakshi, RPAD, Ms K. Srivastava, RPAD, Ms V.K. Phalak and Mr K.S. Phalak, ANI Associates, Mr R.P. Agarwal, TT&CD, Dr V. Venkat Raj, Director, HS&EG, Dr A.S. Pradhan, Head, CD&RS, RPAD, Mr A.M. Patankar, Head, TT&CD and Ms P.K. Pal, TT&CD

use of $CaSO_4$:Dy as radiation detector. It works on the phenomenon of thermoluminescence. The badge is worn on the user's clothing at the chest level. The badges are read periodically – monthly, quarterly or halfyearly, as per the environment of work. These badges can be reused upto approximately 20 times.

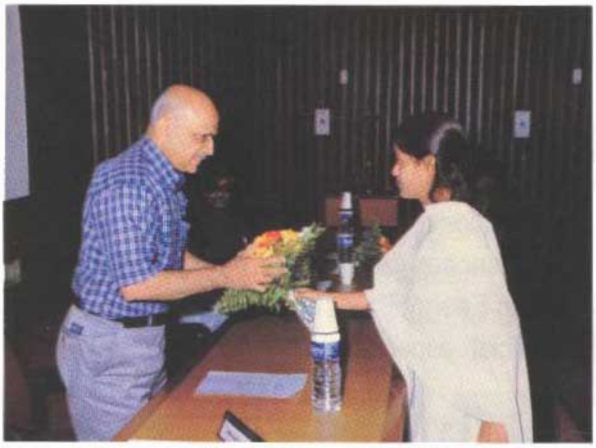
This technology has been developed by Radiological Physics & Advisory Division (RPAD), BARC. Technology Transfer and Collaboration Division (TT&CD) has coordinated complete technology transfer process involving preparation of technology documents & technology transfer agreement.

TRAINING COURSE ON HEALTH PHYSICS AND RADIOLOGICAL SAFETY

The IX Batch of One Year Health Physics Stipendiary Training Course (BARC and NPCIL batches) was inaugurated at the Health Physics Division auditorium, Radiation Protection Training and Information Centre, CT&CRS building, Anushaktinagar on February 3, 2003 by Dr V. Venkat Raj, Director, Health, Safety & Environment Group, BARC. Mr A.K. Gore, Executive Director (O), NPCIL, graced the occasion as the Guest of Honour. Heads of Divisions of HS&E Group, BARC, senior officers from NPCIL, BARC and AERB were also present.

In his welcome address, Mr R.M. Sharma, Head, Health Physics Division, briefed the efforts made by Health Physics Division to provide trained manpower in Radiological Safety to meet the needs of the expanding activities of the Department. He also observed that the staff who had passed out through the previous batches of the One Year Training course were doing extremely well in their profession and many of them were able to pursue their desire to improve their academic qualifications also. He also mentioned that Health Physics Division was concurrently running a One Year Training Course for Trainee Scientific Officers to be later posted as Health Physics professionals in Nuclear Power Plants. It was also mentioned that the present batch of 48 trainees would be concurrently trained in 2 separate groups - 30 trainees for NPCIL at Health Physics Laboratory, Tarapur, and 18 trainees for BARC units at RPTIC, CT & CRS building, Mumbai.

Dr V. Venkat Raj, Director, Health Safety & Environment Group, BARC, inaugurating the Training Course



Welcome to the Guest of Honour, Mr A.K. Gore, Executive Director (O), NPCIL

In his address, the Guest of Honour Mr A.R. Gore, Executive Director (O), NPCIL, stressed on the important role played by the Health Physics staff in the expanding Indian Nuclear Power programme and the importance of improving production without compromising on safety aspects. He also remarked, while lighting the traditional lamp, that lighting the lamp was symbolic of removing darkness - darkness of ignorance to be removed by education and experience gained through the training course. He also remarked that the important role played by the Health Physics staff in ensuring safety of the plant personnel, meeting the regulatory requirements and the efforts made for the environmental protection are held in high esteem in the Department of Atomic Energy.

Inaugural address by Dr V. Venkat Raj, Director, HS&EG, BARC

The course was formally inaugurated by Dr V. Venkat Raj, Director, HS&E Group, BARC. In his inaugural address, he stressed on the importance of maintaining high standards for the training course and the need to mould the trainees to meet the tough challenges of the future. He reminded the important role to be played by the Health Physics staff in ensuring safety in the operating units and also the necessity of building up a strong R&D base to support the on-going programmes of the department. He also remarked that it was heartening to see that the staff who had passed out through the previous training batches were holding responsible positions in different units. In this context, he stressed the need for the Health Physics Staff to remain ever vigilant, enforce the safety regulations and build up a safety culture in the department. He emphasized the need of maintaining high standards in radiation protection especially as the Health Physics Staff have to play the added responsibility as the representative of the regulatory body.

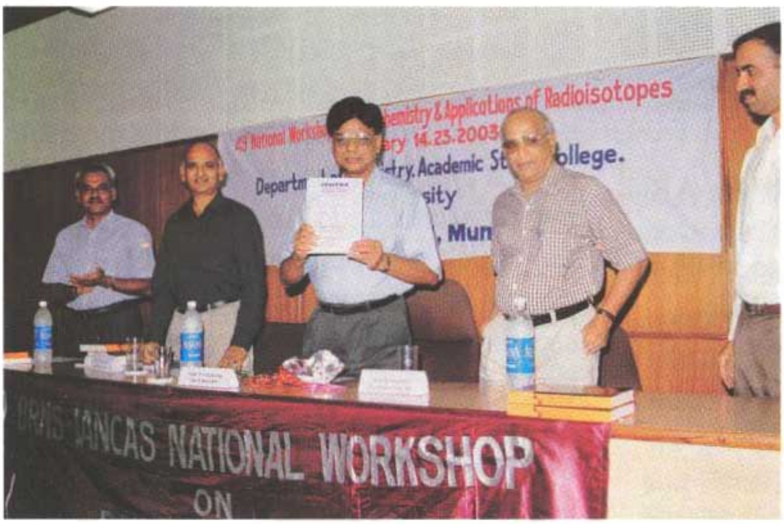
The function was concluded by vote of thanks proposed by Mr K. Narayanan Kutty, Officer-in-Charge, Training Group, HPD. He also briefed on the efforts being taken by the Training Group of HPD to make the training programme effective and the sustained efforts made for improving the standards of the course.

WORKSHOP ON RADIOCHEMISTRY AND APPLICATIONS OF RADIOISOTOPES

Indian Association of Nuclear Chemists and Allied Scientists (IANCAS) conducted its 49th National Workshop on "Radiochemistry and Applications of Radioisotopes" at the Department of Chemistry, Goa, University, Goa, during January 14-24, 2003.

The Workshop was inaugurated by Prof. P.S. Zacharias, Vice-Chancellor, Goa University. Prof. Zacharias lauded the role played by the

Department of Atomic Energy in undertaking public awareness programmes to dispel the fears dormant in the minds of the people about nuclear energy. He suggested for increased collaborative interaction of universities with BARC by arranging visits of students to expose them to the amazing facilities that exist in BARC so that students are encouraged to opt for basic sciences for career development.



Inauguration of the Workshop by Prof. P.S.Zacharias, Vice-Chancellor, Goa University. Others in the photograph (L-R) are Prof. K.S.Rane, Head, Chemistry Dept., Goa University, Dr G.A. Rama Rao, FCD, BARC, and General Secretary, IANCAS, Dr S.B. Manohar, Head, Radiochemistry Division, BARC, and President, IANCAS, Dr V.S.Nadkarni, Organising Secretary, Dept. of Chemistry, Goa University

Prof. K.S.Rane, Head, Chemistry Department, Goa University, while welcoming the participants for the Workshop said that this Workshop had generated interest in the local colleges and several requests were received from local degree colleges for conducting one-day workshops. Dr S.B. Manohar, Head, Radiochemistry Division, BARC and President, IANCAS, briefed the participants on the various activities of IANCAS to popularise the subject of Nuclear and Radiochemistry by organising the workshops, giving away awards to young scientists and bringing out thematic bulletins periodically for free distribution to all its life members, with 70% of them drawn from academic institutions. Dr G.A. Rama Rao, General Secretary, IANCAS, described the course content of the Workshop with an aim of providing hands-on experience in using radioisotopes through simple experiments. Dr S.B. Manohar gave the keynote address on the 'Atomic Energy Programme in India'. He outlined beneficial aspects of radioisotopes in various fields. Dr V.S. Nadkarni, Organising Secretary, proposed the vote of thanks.

Special lectures were given by Dr R.B. Grover, Director, Strategic Planning Group, DAE, and Associate Director, TC&IRG, BARC, on 'Contribution of BARC in Science and Technology'; Dr R. Bandekar, Food Technology Division, BARC, on 'Radiation in Food Preservation'; Dr M.R.A. Pillai, Head, Radio-pharmaceuticals Division, BARC, on 'Isotopes for therapeutic applications: Contribution of BARC' and Mr Surendra Kumar, Waste Management Division, BARC, on 'Treatment of Nuclear Waste'.

Participants with the experiment on Solid State Nuclear Track Detector (SSNTD) conducted by Dr P.C.Kalsi from IANCAS

Eight colleges were visited by IANCAS members to give a lecture on 'Theory of Radioactivity' and conducted two simple experiments on (a) Half-life determination of Ba^{137m} (2.55 min), and (b) Natural beta radiation present in the environment by GM counter, to more than 1000 students of 12th std and final B.Sc.. Many of the teachers came forward to ask simple questions on natural radioactivity that is present in the human body and the quality of food after irradiation.

Mr Arjun, BRIT, demonstrating an experiment with Tc-generator

A group of journalists visited the laboratories to interact with the resource persons and the participants and to enquire with the participants about their experience in handling the sealed radioisotopes in the university laboratory.

A team of resource persons from IANCAS and the Goa University. Standing (L-R): Mr D.R. Prabhu, Dr V.S..Nadkarni, Goa Univ., Dr U.M. Kasar, Dr .P.C.Kalsi, Dr S.B. Manohar, Mr Rahul Tripathi, Prof. K.S. Rane, Goa Univ., Dr S.K. Mukerjee, Dr G.A. Rama Rao, Dr Srinivasan, Goa Univ., Dr S. Kannan, and Dr M.S .Nagar, Sitting (L-R): Ms Chanda Arjun, Mr Arjun, Mr K. Sudarshan and Mr D.B.Paranjape

The feedback received from the participants was encouraging. The instruments were donated by Dr M.R.A.Pillai, Head, Radiopharmaceuticals Division, BARC, as Chief Guest on behalf of IANCAS. He expressed the hope that the University would propagate the subject among the educational institutions in the vicinity with the help of these instruments. Prof. Budkuley, Registrar, Goa University, presided over the function, and Dr P.R. Pednekar, Head, Quality Assurance & Occupational Hazard, Syngenta India Ltd, a Guest from the University, distributed the certificates to the participants and the research scholars.

Dr G.A.Rama Rao, General Secretary, IANCAS and Coordinator of the Workshop, answered the feedback queries and expressed gratefulness to the authorities of BRNS, Dr Anil Kakodkar, Chairman, DAE, Mr B.Bhattacharjee, Director, BARC, for providing unstinted support to the activities of IANCAS. He also thanked Dr S.B. Manohar, Head, Radiochemistry Division, BARC, and President, IANCAS, Dr V. Venugopal, Head, Fuel Chemistry Division, BARC, and Vice-President, IANCAS, for their encouragement.

FORTHCOMING SYMPOSIUM

The National Symposium on Environment, sponsored by the Board of Research in Nuclear Sciences, Department of Atomic Energy, has been addressing the various environmental issues prevalent in the country. Since 1991, eleven such symposia held so far at different places, covering various environmental issues relating to air, water, soil and waste management as focal themes, have brought scientists, technocrats and entrepreneurs under one umbrella for effective deliberations on the relevant topics.

Continuing with this objective, the Twelfth National Symposium on Environment (NSE-12) is being held at H.N. Bahuguna Garhwal University, Tehri Garhwal, during June 5-7, 2003 with "Environmental Protection Strategies for Sustainable Development" as the focal theme.

The symposium is being jointly organised by H.N. Bahuguna Garhwal University and the Health, Safety & Environment Group of BARC, Mumbai, in collaboration with the Narora Atomic Power Station, Narora. The Major topics being covered in the symposium include :

1. Environmental Quality Monitoring & Modeling
2. Waste Management & Mitigation Strategies
3. Environmental Radioactivity
4. Bio-indicators & Bio-remediation
5. Industrial Pollution
6. Envionmental Impact Assessment & Management Plans
7. Environmental Ecology
8. Environmental Awareness and Education

For further details, contact :

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(E-mail : rcramola@nde.vsnl.net.in)
or, Dr T.N. Mahadevan, Co-Convener, Environmental Assessment Division, Bhabha Atomic Research Centre, Mumbai 400 085. Tel. (O) 22-25595365; Fax (O) 22-25505151
(E-mail :devan@apsara.barc.ernet.in)

भा.प. अ. केंद्र के वैज्ञानिकों को सम्मान / BARC SCIENTISTS HONOURED

• डॉ. डी. एन. साह, अध्यक्ष, सूक्ष्मधातु विश्लेषण एवं ईंधन मौडलिंग अनुभाग, पश्च किरणन परीक्षण प्रभाग, भाभा परमाणु अनुसंधान केंद्र को दिसंबर 21, 2002 में धातुकी इन्जीनियरिंग विभाग, बीआइटी सिन्द्री, झारखंड, के द्वारा प्रतिष्ठित स्नातक पुरस्कार ("Distinguished Alumnus Award") प्रस्तुत किया गया। यह पुरस्कार उन्हें नाभिकीय पदार्थ चरित्रीकरण एवं नाभिकीय ईंधन और घटकीय संरचनात्मक विकास के क्षेत्र में प्रमुख योगदान के लिये प्रदान किया गया ।

Dr D.N. Sah, Head, Micrometallurgical Analysis and Fuel Modelling Section of Post Irradiation Examination Division, BARC, was presented the "Distinguished Alumnus Award" by Department of Metallurgical Engineering, BIT, Sindri, Jharkhand, on December 21, 2002. The award was conferred on him for his contributions in the field of nuclear material characterization and development of performance analysis models for nuclear fuels and structural components.

• डॉ. पी. आर. वैद्या, परमाणु ईंधन प्रभाग, भाभा परमाणु अनुसंधान केंद्र को दिसंबर 2002 में चिनै में इंडियन सोसायटी फॉर नॉन-डेस्ट्रक्टिव टेस्टिंग (ISNT) के वार्षिक सम्मेलन में इस वर्ष का (NDT) मैन ऑफ द ईयर (R&D) से पुरस्कृत किया गया। यह पुरस्कार उन्हें तामिलनाडु के राज्यपाल माननीय श्री. पी. एस. राममोहन राव के द्वारा प्रदान किया गया ।

इससे पहले ISNT की मुंबई शाखा ने डॉ. वैद्या को अचीवमेंट पुरस्कार (Achievement Award) (R&D) के लिये भी चुना था ।

Dr P.R. Vaidya, Atomic Fuels Division, BARC, was awarded NDT Man of the year (R&D) by the Indian Society for Non-destructive Testing (ISNT) at its annual Conference at Chennai in December 2002. It was given away by the Governor of Tamilnadu, Hon. Mr P.S. Ramamohan Rao.

Earlier to this, Dr Vaidya was chosen for the Achievement Award (R&D) by the Mumbai chapter of ISNT.

Edited and published by Dr Vijai Kumar, Head, Library & Information Services Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085.

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