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BARC NEWSLETTER

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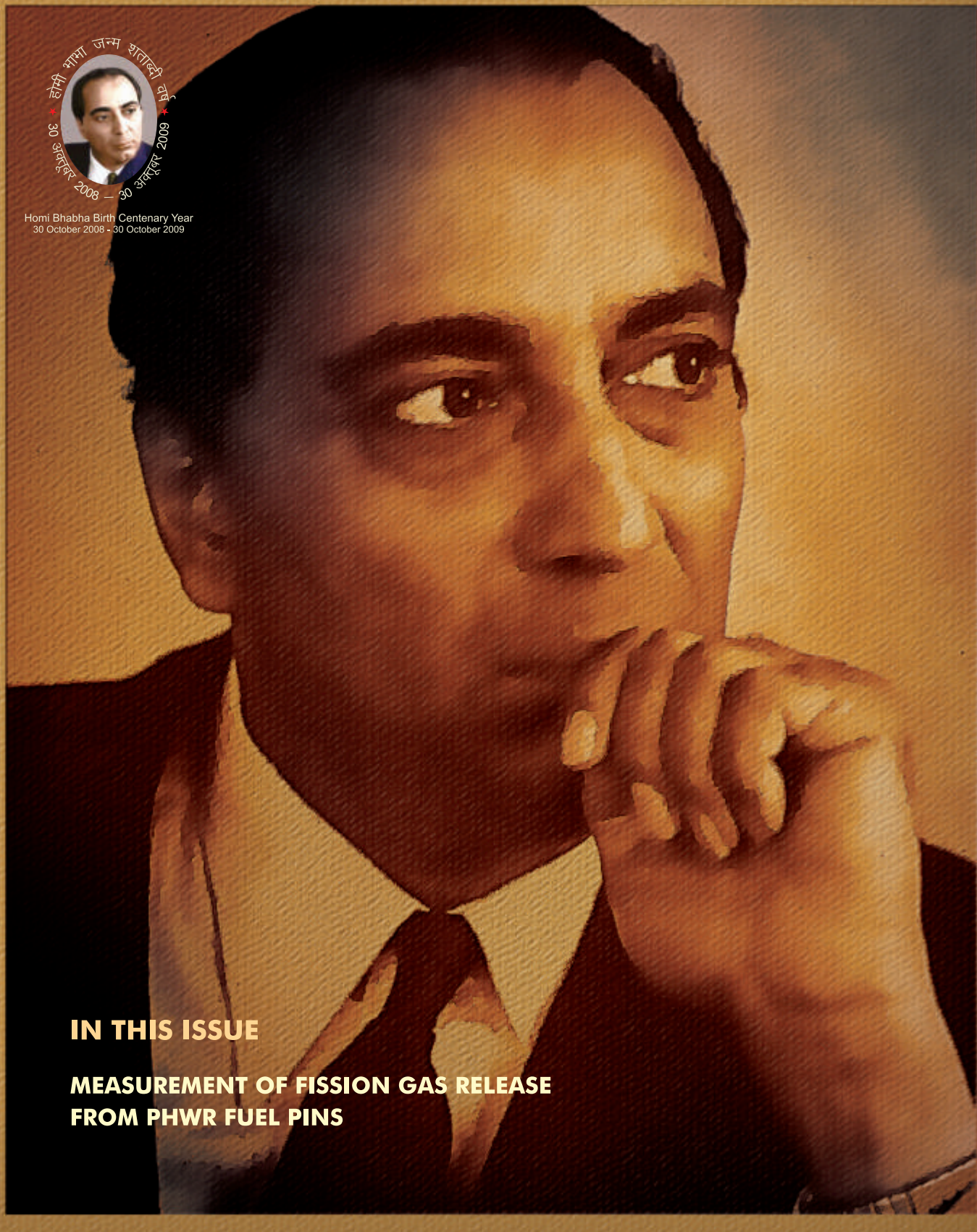

IN THIS ISSUE

MEASUREMENT OF FISSION GAS RELEASE FROM PHWR FUEL PINS

In the forthcoming issue

A review on the development of enrichment scanners for Plutonium and Experimental Uranium nuclear fuel

Stringent testing for uniformity, enrichment and the active stack length specifications of each nuclear fuel pin is required, for optimum fuel performance. This is achieved through a non-destructive assay technique called gamma scanning. In the present article, three gamma scanners fabricated for FBTR fuel pins, MOX fuel pins and for gamma absorption fuel densitometry have been described.

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MEASUREMENT OF FISSION GAS RELEASE FROM PHWR FUEL PINS

U. K. Viswanathan, P. M. Satheesh, S. Anantharaman
Post Irradiation Examination Division

Introduction

Approximately 15% of the fission product inventory in irradiated nuclear fuel, comprises of noble gases Xenon (Xe) and Krypton (Kr), in different isotopic states. These gases, if released to the fuel-clad gap and / or to the fuel element plenum, reduce the thermal conductivity of the cover gas and retard the heat removal from the fuel. Consequently the fuel temperature increases, releasing more gas to the plenum. Moreover, high thermal gradient in the fuel during power generation and the thermal shocks experienced by the fuel elements due to the movement of control rods, produce cracks in the normally brittle ceramic fuels. These cracks also act as fast conduits for the release of fission gases to the fuel-clad gap.

The measure of fission gases released in the fuel element testifies to the performance of the fuel. In general, fuels are designed with sufficient porosity to enable them to retain most of the generated gases within the matrix. During a postulated Loss Of Coolant Accident (LOCA), depressurization of the coolant occurs. When the coolant pressure drops to a value less than the fission gas pressure of the fuel pin, the clad creeps out, resulting in the ballooning of the clad. Coolant flow in the channel further reduces, thereby increasing the temperature of the fuel. Thus, knowledge of internal pressure of the fuel pin, is also a safety requirement. Xe and Kr have different isotope ratios when produced from fission of uranium or plutonium. Therefore, the isotope composition of the fission gases provides additional information on their source of production.

This article describes the fission gas measurement set-up (installed at the PIED hot cells) and the experimental details and also presents the results obtained from the tests carried out on fuel pins from 19-element UO_2 PHWR fuel bundles irradiated to different burn ups from 2,500 MWd/tU to 15,000 MWd/tU in various reactors. Results from one ThO_2 fuel bundle irradiated to nominal burn up of 11,000 MWd/tTh are also included for comparison. The pattern of fission gas release is compared with the data from Ontario Hydro 37-element fuel pins.

Description of the Apparatus

Puncture Chamber and Gas Measurement System

The schematic diagram of the fission gas measurement system is shown in Fig.1 and the photograph of the actual system is shown in Fig. 2. The hot cell windows can be seen in the background.

The system consists of a remotely operated leak-tight puncture chamber of very low dead volume, placed inside a hot cell (shown in Fig. 3 (a)). The salient feature of the chamber is that, it is adaptable to fuel pins of MOX and PHWR designs. The chamber is connected to the collection system located in the operating area by a 2mm bore stainless steel tube, passing through 1200 mm thick shielding wall of the hot cells, as shown in Fig. 3 (b). The fission gas collection system with a substantially low dead volume has been fabricated, with all components made of stainless steel. The low dead volume of the system, enhances the sensitivity of volume and pressure measurements of released

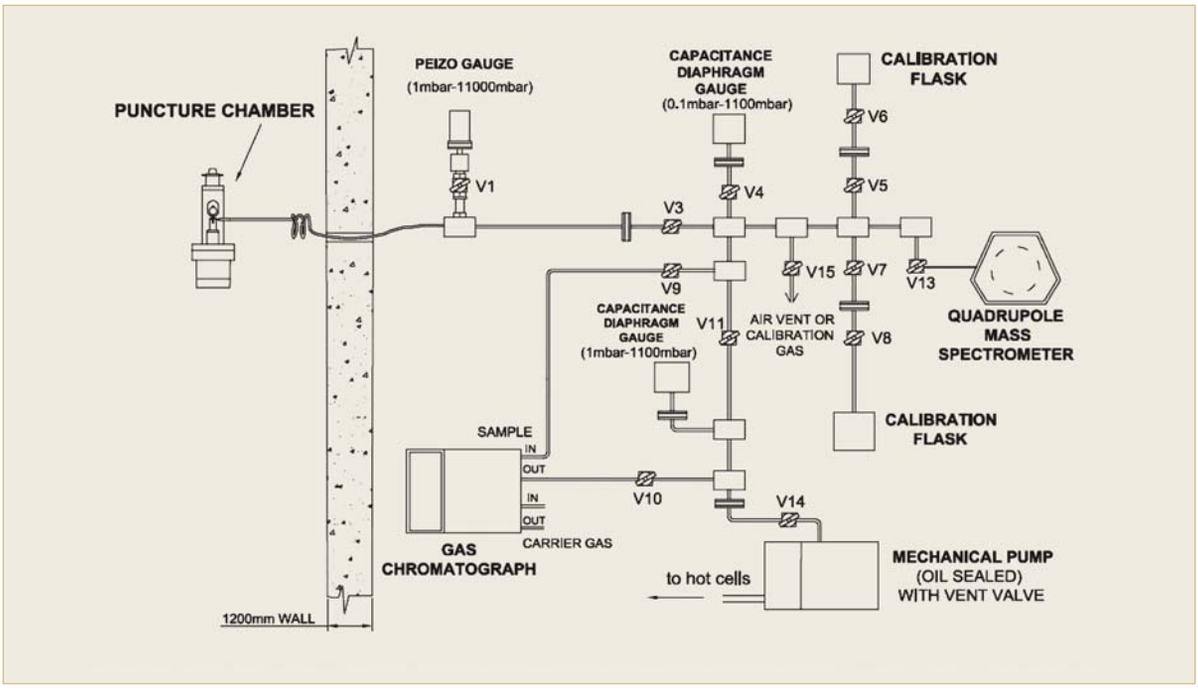

Fig. 1 : Schematic diagram of fission gas collection and measuring system

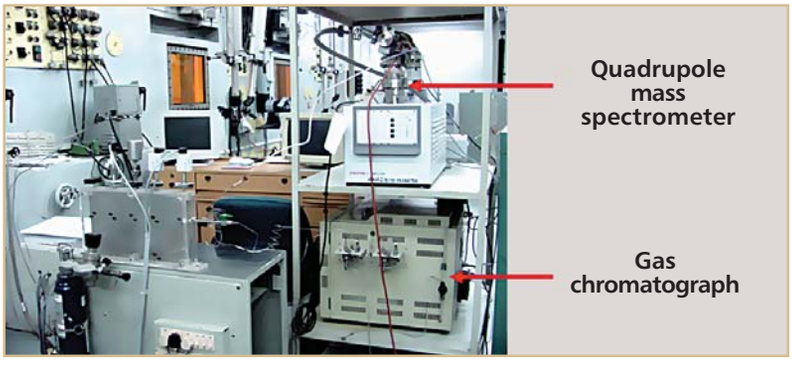

Fig. 2 : Fission gas collection and measuring system located outside the hot cells

fission gases from PHWR fuel pins, which are of low void volume. Fission gas pressure measurements are carried out using a capacitance diaphragm gauge operated within the range of 0.1 Torr to 1100 Torr. The experimental details and the methodology used in the quantitative estimation of released fission gases are described elsewhere [1].

Gas Chromatograph (GC)

A dual column gas chromatograph, packed with molecular sieve in a 6 mm diameter stainless steel column of 3 m length was used, to estimate the composition of the released fission gas. Helium was used as the carrier gas. A thermal conductivity detector with tungsten-rhenium filaments was used for detection. Since the fission gases being injected to the GC from the measuring system are at sub-ambient pressure, pre-calibration of the number of molecules of the constituent gases against the peak areas was carried out before the test, by injecting Xe-Kr-He gas mixture with known composition and at known pressure.

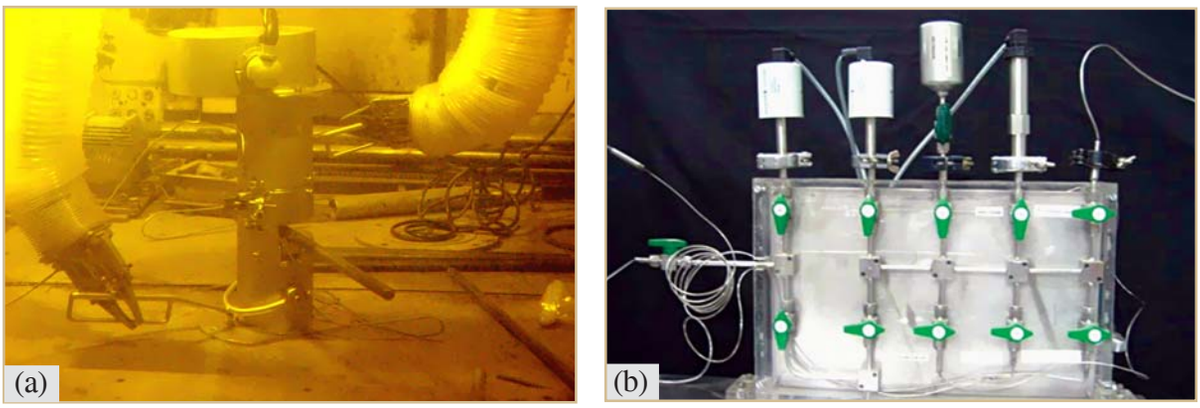

Fig. 3 : a) Remotely operated puncture chamber inside the hot cell and b) Pressure measuring part in the operating area outside the hot cells

Quadra Pole Mass Spectrometer (QMS)

A quadrupole mass spectrometer with a mass range of 1-300 amu was used, for estimating the isotope ratios of the fission gases Xe and Kr. The gases were ionized using a tungsten gas tight ion source and detected using Channeltron / Faraday detector. The gas from the measuring system is admitted to the analyzing chamber of the QMS through a heated non-discriminating gas inlet capillary system. A turbo molecular pump backed by a dry diaphragm pump provided a very low pressure, less than 10^{-5} mbar. Analysis was carried out in Multiple Ion Detection (MID) mode, with 0.5 second dwell time for each mass number. The isotope ratios of Xe and Kr were estimated from ionization currents of the respective isotopes. The mass calibration of the spectrometer was carried out, by admitting Xe, Kr and He gas mixture of known chemical and natural abundance isotope ratios.

Fig. 4 : Typical 19-element PHWR fuel bundle

Fuel Pins from PHWR Fuel Bundle

A typical 19-element PHWR fuel bundle is shown in Fig. 4. Puncture tests were carried out on dismantled fuel pins from the 19-element UO_2 fuel bundles, with the average burn up in the range of 2,500 -15,000 MWd/tU received from different reactors. Fuel pins were selected from the outer, intermediate and the central regions of the bundles.

Results

Fission gas release data from the fuel pins from two UO_2 fuel bundles which were discharged after an extended burn up of about 15,000 MWd/tU from Kakrapar Atomic Power Station (KAPS) are given in Table 1(a).

Location of the pin in the respective bundles, percentage fission gas release, ratio of Xe to Kr and the inside pressure inside the cladding are given in the Table. The burn up of the individual fuel pins is calculated from the power factor, obtained from the reactor operator.

Table 1(a): Fission gas release data from high burn up UO_2 fuel pins from PHWR

Bundle average burn up, MWd/tU	Location of the pin	Pin burn up, MWd/tU*	Fission gas release, %	Xe / Kr ratio	Internal pressure at 300 K, MPa
15,161 (KAPS-2)	Outer	16,070	16.9	12.2	2.2
			18.9	12.1	2.2
			16.2	12.2	2.2
	Middle	13,645	1.0	8.8	0.3
			1.0	10.3	0.4
	Center	12,890	0.1	9.5	0.3
14,581 (KAPS-1)	Outer	15,460	22.2	12.1	2.8
			20.5	12.0	2.6
			19.4	12.1	2.4
			19.3	12.1	2.1
			22.0	12.1	2.4
	Middle	13,120	1.7	7.8	0.4
			2.1	7.7	0.4
	Centre	12,390	0.7	8.4	0.3
* Power factors: 1.06 for outer pin, 0.9 for middle pin and 0.85 for outer pin					

Table 1(b): Fission gas release data from low burn up UO_2 fuel pins from PHWR

Bundle average burn up, MWd/tU	Location of the pin	Pin burn up, MWd/tU*	% fission gas release	Xe / Kr ratio	Internal pressure at 300 K, MPa
7,671 (NAPS-1)	Outer	8,130	8.8	11.5	0.6
			7.8	10.7	0.5
	Middle	6,900	0.1	9.5	0.2
			0.2	8.5	0.1
	Centre	6,520	0.1	10.1	0.1
4409 (KAPS-1)	Outer	4,670	0.2	10.5	0.1
			0.2	9.0	0.3
			0.2	8.4	0.1
	Middle	4,410	0.1	7.5	0.2
2,600 (NAPS-2)	Outer	2,760	0.5	7.7	0.2
			0.8	11.6	0.2
* Power factors: 1.06 for outer pin, 0.9 for middle pin and 0.85 for outer pin					

Results obtained from normally discharged bundle and other low burn up bundles are given in Table 1(b). Fuel pins from the ThO_2 fuel bundle did not show any perceivable gas release. However, mass spectrometric analysis of the residual gas inside the fuel pins was carried out and a distinct difference in the isotope ratios of fission gases was observed between UO_2 and ThO_2 fuel pins.

Release data from all the tested fuel pins along with the data available from the pins from the 37-pin fuel bundles from the Ontario Hydro Generating Station [6], are plotted in Fig.5. The locations of the fuel pins in the bundle are identified in the plot as shaded, partially shaded and open symbols, respectively for the outer, intermediate / middle and the inner / central fuel pins. Higher release for the outer fuel pins is clearly noticeable in all the fuel bundles. The release from the outer pins of the19-element Indian PHWR fuel bundles, discharged after extended burn up of about 15,000 MWd/tU, is much higher than that observed from the outer elements of the 37-element fuel bundles of the Ontario Hydro Generating station.

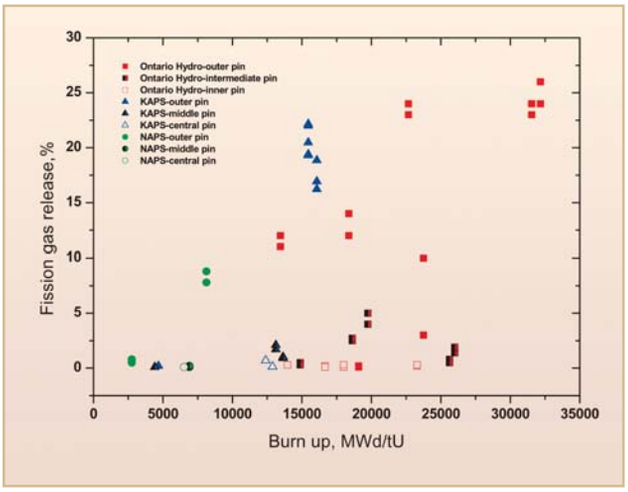

Fig. 5: Comparison of release data from Indian PHWR 19-pin with Canadian 37-pin data

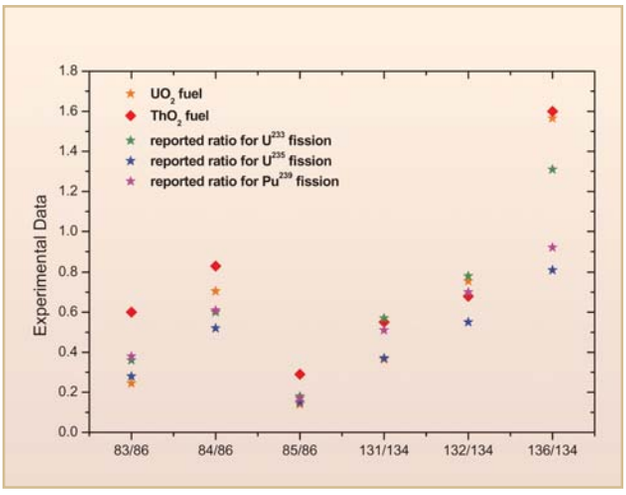

Fig. 6: Isotope ratios of fision gas released from UO_2 and ThO_2 fuel pins from PHWR

The isotope ratios of released gases, from extended burn up of UO_2 fuel bundles and from one ThO_2 fuel bundle, irradiated to nominal burn up of 11,000 MWd/tTh are shown in Fig. 6. Published data on ratios available for U^{233}, U^{235} and Pu^{239}, are also marked in the plot.

Discussion

Significantly high fission gas release was noticed in the outer fuel pins of all the fuel bundles, with corresponding increase in the internal pressure in the pin. For the fuel bundle discharged after extended burn up of about 15,000 MWd/tU, fission gas release varied from 16-22% for the outer pins to less than 1% for the central pin. The large variation in gas release is attributed to the higher linear heat rating and higher fuel temperature, experienced by the outer fuel pins with respect to the intermediate and the central pins. The observed fission gas release behaviour, corresponded well with the fuel restructuring revealed during metallography in the fuel cross section [2]. Microstructure in the outer pin showed grain growth region extending up to 50% of fuel radius. High temperature diffusion and grain boundary sweeping are believed to have caused high release in the outer pin [3]. Xenon to Kr ratio also shows a systematic variation from the outer to the central fuel pin, akin to the release pattern. This could be

attributed to the variation in the thermal histories of the fuel pins. The measured values of Xe / Kr ratios varied from 7.5 to 12.2, the maximum being for the peripheral pins. Xe to Kr ratio in the fission gases produced, is about 7 for the fission of U^{235} and about 19 for the fission of Pu^{239} [4]. The release fraction of Kr from the fuel matrix is expected to be higher than that for Xe, by virtue of the higher diffusivity of the former. Therefore, the Xe / Kr ratio in the released gases is expected to be lower than the generation ratio.

In the case of UO_2 fuel, except for Xe^{136} / Xe^{134}, the isotope ratios as measured from QMS, also show a mixed trend of fissions from U^{235} and from Pu^{239}. While the ratios Kr^{84} / Kr^{86} and Xe^{132} / Xe^{134} match close to Pu^{239} fission, the ratios Kr^{83} / Kr^{86} and Xe^{131} / Xe^{134} are suggestive of U^{235} fission. The high value Xe^{136}/Xe^{134} is due to the formation of Xe^{136} from Xe^{135} by neutron absorption, which is not accounted for in the reported yield ratio of Xe^{136}/Xe^{134} [5]. Limited results generated from the isotope measurement of fission gases from ThO_2 fuel show only the closeness of Xe^{131} / Xe^{134} to that reported for U^{233} fission.

Summary

The findings from the fission gas release measurements, carried out on PHWR fuel pins irradiated to different burn ups from 2,500 MWd/tU to15,000 MWd/tU at different Indian reactors, can be summarized as follows:

1. At all burn ups, the outer elements released significantly more fission gas than the inner ones. For a normal discharge burn up of about 7,500 MWd/tU, the maximum release from the outer pin was 9% , resulting in an internal pressure of 0.6 MPa at room temperature.
2. At burn up of 15,000 MWd/tU, fission gas release from the outer pins was 16-22%, when the middle pin and the central pin released 2% and 1%, respectively. The internal pressure of the outer pins, corresponding to the burn up of 15,000 MWd/tU was in the range of 2.1-2.8 MPa.
3. Xenon to krypton ratio also varied with the location of the pin in the bundle, the maximum being for the outer pin.
4. The measured values of Xe / Kr ratio for natural UO_2 PHWR fuel were between the values reported for the thermal fission for U^{235} and that for Pu^{239}.
5. The isotope ratios of Xe and Kr also showed mixed trend of fissions from U^{235} and Pu^{239} for natural UO_2 fuel.
6. The isotope ratio of fission gas Xe corresponded with that for U^{233} fission, in case of ThO_2 fuel pins.

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BARC TRANSFERS "MULTICHANNEL ACOUSTIC EMISSION ANALYZER (AEA) SYSTEM"

The technology of "Multichannel Acoustic Emission Analyzer (AEA) System" developed by the Control Instrumentation Division, has been transferred to M/s Crompton Greaves Ltd. on 12th February, 2009.

The technology consists of the procedures involved in the making of a Multichannel Acoustic Emission Analyser System. The Acoustic Emission technique has a variety of applications in Material Characterization Studies, Structural Testing, Corrosion and Leakage testing, Online Power Transformer Diagnosis and Production Quality Control etc. The hardware technology part of the system consists of 6-layer PCI card (AEDAQ) having digital and analog modules with 4 independent input channels. The digital module includes the PCI controller for fast throughput, a DSP for signal processing and an FPGA for AE parameter extraction. The input section analog module consists of 14-bit ADC and band-pass filters. The software technology comprises of the PCI driver module and the front end Windows-based GUI. It also includes signal analysis and display modules. The system operates in three modes viz. the AE Parameter Mode, AE Waveform Mode and the AE Location Mode.

M/s Crompton Greaves will be utilizing this technology for the manufacture of online diagnosis system, to test electrical equipment such as Power Transformers, Circuit Breakers etc.

The Technology Transfer and Collaboration Division coordinated all the activities related to the transfer of this technology.

After signing the technology transfer agreement with M/s Crompton Greaves Ltd., Mumbai. Seen sitting from right to left are Mr. S.S. Kulkarni, TT&CD, Mr. H.R. Mehta, CnID, Mr. U. Mahapatra, Head, CnID, Dr. Vijai Kumar, Associate Dir. KMG and Head, SIRD, Mr. G. P. Shrivastava, Dir. E&I Group, Mr. A. Venkatasami, DGM, M/s Crompton Greaves Ltd (CGL), Mr. Murlidhar Nikam, M/s CGL, Mr. Suresh Rajan, M/s CGL, Dr. S. Sarvanan, M/s CGL. Standing from right to left are Ms. S. S. Murudkar, TT&CD, Ms. S.S. Mule, TT&CD, Ms. K. G. Menon, CnID, Mr. A. K. Rao, CnID, Mr. Yogesh Dhake, CnID, Mr. A. K. Singh, CnID.

REPORT ON THE DAE-BRNS THEME MEETING ON NEUTRON ACTIVATION ANALYSIS (TMNAA 2009)

A two-day DAE-BRNS Theme Meeting on Neutron Activation Analysis (TMNAA 2009) was jointly organized by the Analytical Chemistry Division and the Radiochemistry Division during 23-24 March, 2009 at BARC, Mumbai. This meeting was organized as a follow-up to the DAE-BRNS Discussion Meeting on Current Trends and Future Perspectives of NAA (CFNAA 2006) held during November 16 -17, 2006 at BARC, wherein it was concluded that, organizing a Co-ordinated Research Project (CRP) for a period of three years under BRNS, DAE, with participation from Universities using NAA as the main technique, would be fruitful. The aim of the TMNAA 2009 was to select suitable project proposals for the proposed CRP, to enhance the utility of research reactors and NAA technique and to develop trained manpower. A total of 21 proposals from academic institutes / universities and 10 proposals from DAE units were received for presentation during TMNAA 2009. The proposals were categorized under various fields like environment, geology, biology, biomedical, archaeology, agriculture, food and nuclear technology.

The inaugural session of the TMNAA 2009 was held at 09:30 hours on March 23, 2009 at A Block Auditorium, BARC. A total of 60 delegates participated; 37 delegates were principal or co-investigators of the project proposals that were discussed in TMNAA 2009. The inaugural session was presided by Dr. T. Mukherjee, Director, Chemistry Group, BARC. Dr. Rakesh Verma, Convener, welcomed the participants and invitees. Dr. A V. R. Reddy, Head, Analytical Chemistry Division and Chairman TMNAA 2009 explained the details about the scope of TMNAA 2009. He said that 10 non-DAE and 5 DAE projects are expected to be selected during TMNAA 2009, for inclusion in the proposed

From left to right : Mr. D.D. Sood (Former Director, RC&IG), Dr. A. V. R. Reddy (Head, ACD and Chairman-TMNAA 2009), Dr. T. Mukherjee (Director, CG), Dr. V. Venugopal (Director, RC&IG), Dr. S.G. Markandeya (Scientific Secretary-BRNS, Dr. S.V. Narasimhan (AD, CG) at the inaugural session of TMNAA 2009

CRP. Dr. Mukherjee appreciated the idea of the Theme Meeting and thanked all the participants for their interest. He advised those participants who would not get selected at the CRP, to take advantage of this meet for a fruitful collaboration with BARC using NAA. Dr. V. Venugopal, Director, RC&IG, BARC in his key note remarks, discussed the need as well as the importance of NAA in various fields, encompassing geology, environment, medical sciences and nuclear technology by citing many examples. Dr. Venugopal stressed the need for reference materials for NAA work as well as other R&D activities and urged everyone to give priority to this work. Dr. S.G. Markandeya, Member Secretary, BRNS, highlighted the use of NAA and encouraged the participants and organizers to critically deliberate each proposal, so that the outcome would be positive in the form of a CRP on NAA that would emphasize trained manpower in radioactivity measurements which would be useful to DAE. Other dignitaries who addressed the delegates were Dr. S.V. Narasimhan, Associate Director, Chemistry Group and Head, Water & Steam Chemistry Division, BARCF, Kalpakkam and Dr. D.D. Sood, Former Director, RC&IG, BARC. Both of them stressed the importance of NAA in R&D work. The vote of thanks was proposed by Dr. R. Acharya, Secretary, TMNAA 2009.

In the first technical session, Dr. A.V.R. Reddy delivered a lecture on "Neutron Activation Analysis: Methodologies and Applications". He described the principle of NAA, utilization of research reactor for NAA, capability, advantages and limitations of NAA. Some of the important developments made at RCD and ACD, BARC using conventional NAA, k_0-based NAA, PGNAA and chemical NAA methods and their applications to various R&D studies, were presented. It was followed by presentation of the proposals by either Principal Investigator (PI) or Co-investigator (CI). A total of 19 non-DAE proposals and 8 DAE proposals were presented. The non-DAE proposals were from IIT Roorkee, Thapar University, Panjab University, University of Lucknow, Dayalbagh Educational Institute, Manipur University, Mangalore University, Manipur University, Sambalpur University, Y.V. University, GITAM University, Periyar University, Nagpur University, Pune University, JSPM's Imperial College and K.C. College Mumbai. The DAE proposals were from BARC (NABTD, EAD, HPD and FCD), CFSL at ACD, IGCAR, Kalpakkam, AMD, Hyderabad and SINP, Kolkata. All the proposers made an effort in their presentations to comply with the guidelines provided in the "presentation template" sent to them in advance by the organizers, so as to bring out the salient scientific features of each proposal. Presentations were focused and each presentation was followed by intense discussions initiated by the section committee members. All the delegates took part in the discussions. The Selection committee consisting of Dr. P N. Bajaj (Chair), RPCD, Prof. A N. Garg, Ex-IIT, Roorkee, Dr. P.K. Pujari, RCD, Dr. Rakesh Verma, ACD and Dr. R. Acharya, RCD evaluated the presentations. Each presentation was critically discussed, queries were answered and technical advice was offered.

A panel discussion was held on 24th March 2009. The panel constituted of Dr. P.N. Bajaj (Chair), Dr. A.V.R. Reddy, Dr. A.N. Garg, Dr. R. Parthasarathi (ex-ACD), Dr. Rakesh Verma and Dr. R. Acharya. Some of the participants gave feed back and experts expressed their views on the deliberations. Panel members answered all the queries. The panel members felt that all the projects were good, well presented, though some proposals needed to be more focused. The meeting TMNAA 2009 was concluded, after the distribution of the certificates to the delegates, by Prof. A.N. Garg.

NATIONAL SAFETY DAY CELEBRATION AT BARC

As part of continuing health and safety promotional activity of the Industrial Hygiene and Safety Section, Radiation Safety Systems Division (RSSD), the National Safety Day was celebrated at BARC on March 4, 2009. A poster exhibition and competition and a slogan contest were conducted and film shows were also organized on safety during this programme.

The programme was conducted at the Central Complex Auditorium. The day-long programme commenced with the participants taking the Safety Pledge readout by Head, RSSD. Mr. H. S. Kushwaha, Director Health, Safety & Environment Group, Mr. N.D. Sharma, Controller, BARC and Dr. D.N. Sharma, Head, Radiation Safety Systems Division distributed the prizes to the winners of safety poster and safety slogan competitions. Mr. Kushwaha inaugurated the Safety Poster Exhibition too.

Mr. H.S. Kushwaha, Director, HS&E Group, inaugurating the Safety Poster Exhibition

CELEBRATION OF NATIONAL TECHNOLOGY DAY

The National Technology Day was celebrated at the Central Complex Auditorium, BARC on 11th May 2009.

The Department of Atomic Energy felicitates Scientists & Engineers of its various units, through Homi Bhabha Science & Technology Awards, for their meritorious research work. On this occasion, four such lectures delivered by the Award winners were organized.

Dr. Srikumar Banerjee, Director, BARC in his welcome address observed, that on Budhha Purnima day of 1974, the Pokhran 1 experiment was carried out - in 1998 the Pokhran II experiment and this year when Budhha Purnima fell on the 9th May, the Microwave Generation experiment at the High Pressure Physics Lab in Kalyan. who conducted. On the same day there was a meeting of the Atomic Energy Commission, at the renovated Old Yacht Club building. On National Technology Day, Young Achievers are invited to give a presentation of their work for the benefit of scientists and engineers in our organization. Four distinguished speakers - the awardees of Homi Bhabha Science & Technology Awards for the year 2008 delivered talks on the their respective topics. Mr. A. B. Mukherjee from Reactor Projects Group, BARC spoke on Design & Development of Primary Equipment of Light Water Reactors. The design offers a number of technical challenges for compacting high energy density into a small volume. Dr. Madangopal Krishnan from Materials Group , BARC, lectured on Shape Memory Alloy. Dr. Vivek D. Sanadhya from Electronics & Instrumentation Group, BARC, delivered lecture on

Dr. S. Banerjee, Director BARC, delivering the welcome address

Achievements in the field of Automation & Control and Dr. D.K. Aswal, from Physics Group, BARC, on Molecules on -Si for Hybrid Nanoelectronics.

The Programme was well received by prominent Scientists & Engineers from the Department of Atomic Energy, Employees and the Press.

Dr. D.K. Aswal

Dr. D.K. Aswal delivered a talk on "Molecules - on-Si for hybrid nanoelectronics" : an approach that would take care of the scaling limits of existing microelectronics. He presented new concepts of hybrid molecular devices and discussed deposition of these functional molecules on Si, by "self-assembly" and "electrografting" processes . He showed grafting of mono - and multi - layers of a variety of molecules on Si and demonstrated dielectric, rectification and memory effects at nanometer scale (0.5-2.5 nm). For instance, a specifically designed and synthesized organic molecule , that is, 5-(4- undecenyloxyphenyl) - 10, 15, 20 triphenylporphyrin (TPP-C11), was electrografted on hydrogenated Si (111) surfaces and demonstrated switching and memory effect. He has observed a negative-differential resistance in a layer-by-layer self-assembled 3 aminopropyltrimethoxysilane (APTMS) multilayers and demonstrated the resistive memory effect . He found rectification behaviour in a large number of sigma-pi molecules. He has demonstrated the dielectric behaviour of the alkane monolayers down to three-carbon atom alkyl-chains having thickness of only 0.7 nm. By investigating Fowler-Nordheim tunneling in these monolayers, he has estimated the electron energy barrier height at metal /mono layer interface (~2.5 eV) and effective mass of the charge (0.16 me) in the monolayer. He further demonstrated that the electrically stressed breakdown of these monolayers is >16MV / cm.

Mr. Vivek Sanadhya

Mr. Vivek Sanadhya, Head, Distributed Automation and Control System Section CnID, BARC has the following achievements to his credit in the field of Automation and Control.

* Development of C-PCI SBC-based bused controller racks with TCP / IP and CAN interface for a generic high performance platform for IDSN-32 Antenna Controller for ISRO's Chandrayaan-I mission. This controller will be put to use in MACE telescope and upgradation of GMRT.

* Development of 4-Q flux vector brushless motor drives and DSP-based servo controllers for LCA- Multi -Mode Radar (MMR) .

* Development of Mixed Analog /Digital , 4-Q PWM DC - Motor Drives and Amplifiers for Stabilization and tracking system for Ka band Active Radar Seeker head Antenna .

* Development of PC104 SBC-based single board servo controllers for RMP Speed Scanner and Pressure scanner system.

* Development of MIL-1553-based data acquisition system for PRP DAS and Alarm Annunciation System.

* Development of Ultra low power uController based equipment with encryption and secured TCP / IP communication for safeguards and surveillance.

* Development of 1/2/3 axis Ground-based antenna pedestal and ACU for tracking Remotely Piloted Vehicles (RPV)s. Also currently involved in design and development of 2/3/4 axis Stabilized antenna platforms for satellite communication terminals on Ships and RPVs.
* Development of BCL, a graphical programming language for Traction Control System for WAG-5 Locomotive.

Dr. M. Krishnan

According to Dr. Madangopal Krishnan, Shape memory alloy articles that are deformed, show the remarkable ability of recovering original shape and dimensions upon the application of heat. This natural tendency of the shape memory alloys is derived from the reversible diffusionless "martensitic" phase transformation between the high temperature and low temperature crystal structures on heating or cooling past the characteristic recovery temperature. Research on shape memory alloys has been going on for over two decades at the Materials Science Division, BARC. The focus of this work has been to characterize the martensitic transformations and shape memory behaviour in a variety of known shape memory alloys, which determine the underlying crystallographic and thermodynamic rationale for the shape memory effect and design new alloys with improved properties. In a parallel effort, the development of Ni-Ti shape memory alloys and their possible engineering applications were undertaken. The most successful outcome of this effort has been the development of Ni-Ti heat shrinkable sleeves for the Light Combat Aircraft 'Tejas'. The technology for manufacture of Ni-Ti alloys and the heat shrinkable sleeves is now under transfer to the Foundry & Forge Division of the Hindustan Aeronauticals Limited.

Forthcoming workshop

Molecular/Organic Electronics Devices (MOED-2009)

DAE-BRNS and the Department of Physics, Guru Nanak Dev University have organized a 4 day workshop from September 22-25, 2009 at the Guru Nanak Dev University, Amristar and the Conference Centre, GNDU, Dalhousie. The workshop programme will comprise invited talks and poster presentations. Abstracts on the following topics can be sent to Dr. D.K. Aswal at dkaswal@yahoo.com.

- Unimolecular electronis
- New and renewed vistas for solar cells
- Organic nanowires based field-effect transistors and light emitting diodes
- Organic/inorganic hybrid memories
- Molecular modulation of electronic devices
- Theoretical spectroscopy of organic semiconductors
- Bio-molecular and DNA-based devices

Important Dates

Submission of abstracts	:	July 15, 2009
Acceptance of abstracts	:	August 07, 2009
Submission of accommodation form	:	August 15, 2009

For further details please contact

Dr. D.K. Aswal
Technical Physics & Prototype Engg. Division
BARC, Trombay
Mumbai 400 085
E-mail dkaswal@yahoo.com

Prof. R.K. Bedi
Department of Physics
Guru Nanak Dev University
Amritsar – 143005
E-mail : rkbedi@rediffmail.com

NATIONAL LASER SYMPOSIUM (NLS-08) : A REPORT

The National Laser Symposium the eighth in the series was sponsored by the Department of Atomic Energy, the Board of Research in Nuclear Sciences (DAE-BRNS), and organized in collaboration with the Indian Laser Association (ILA). It was held at the LAser Science and TEchnology Centre, (LASTEC), Delhi, during January 7 to 10, 2009. The symposium provides a platform for young researchers in laser physics and technology, to interact with eminent scientists from India and abroad and to present their latest work.

As in previous years, the National Laser Symposium (NLS-08) covered frontline research in basic laser physics, as well as significant advances in the development and applications of laser technology. In view of the pivotal role played by High Power and High Energy Laser technology in several disciplines of science, the focal theme of the symposium NLS-08 this year was "High Power, High Energy Lasers". The Inaugural session of the symposium included opening remarks by Dr. V.C. Sahni, Director RRCAT & Physics Group, BARC and by Dr. R. Sreehari Rao, Chief Controller, DRDO followed by Keynote address delivered by the Chief Guest, Dr. Rangaswamy Srinivasan, inventor of LASIK with several years of contribution in the field of Laser photo-ablation. Dr. Srinivasan addressed several issues related to "Controlled Etching of Organic polymers and Tissue by Pulsed Ultraviolet Laser Radiation and Ablative photodecomposition" in his presentation.

The four-day symposium included 26 invited talks by leading experts and young researchers from India and abroad and 229 contributory papers were presented as posters. In addition to this, there were 13 thesis submissions at NLS-08 of which 9 oral thesis presentations were made during the symposium. There was also an Evening Plenary Session on the first day of NLS-08, consisting of two talks delivered by Dr. V.K. Saraswat, Chief Controller, DRDO and Dr. L.M. Gantayet, Associate Director, Beam Technology Development Group, BARC.

The Invited talk sessions were broadly grouped under High Power High Energy Laser Technology (Prof. U. Schramm, Dr. K. Ranganathan, Dr. S.K. Bhadra and Dr. A.L. Shah), Laser Matter Interaction (Prof. R.Renalto, Prof. H.Yoneda and Dr. R.A. Chakera), Laser Physics and Technology (Prof. R. Vijaya, Dr. T. Ganguly, and Dr. P. Deb), Lasers in Defence (Dr. A.K. Maini, Dr. I. Singh, & Dr. A.K. Razdan), Laser application in Medical and Materials Science (Dr. D.S. Mehta, Dr. S.K. Majumdar & Dr. S.S. Prabhu), Laser Spectroscopy (Dr.G.P.Gupta, & Dr. Pushpa Rao), Laser Materials and Devices (Dr. C.K. Jayasankar & Dr. A. Khare) and Quantum Optics (Dr. R. Ghosh & Dr. B.K. Goswami), each session being chaired by eminent scientists from relevant fields.

A special issue of '*KIRAN*', Bulletin of the Indian Laser Association (ILA) containing most of these invited talks presented during NLS-08 was brought out and distributed to all delegates. All contributory papers at NLS-08 were presented in three poster sessions held during the first three days of the symposium. The Proceedings of NLS-08 included all invited talks and contributory papers and these were compiled in a CD and distributed to all participants of NLS-08.

The annual general body meeting of ILA was held during an evening session of NLS-08, on 8th January 2009. During the concluding session of the symposium, ILA gave away the Best Poster and Best Thesis awards. A panel of judges assessed the thesis and quality of poster presentations and selected the best in each category.

As hoped, NLS-08 provided an effective platform not only to all our eminent invited speakers to share the latest developments in their fields of research, but also, to all participants from whom we received an overwhelming response, with authors submitting a total of 280 contributory papers which were meticulously reviewed by the referees and 229 papers were accepted for poster presentation at NLS-08. It was heartening to note, based on feedback provided by delegates attending NLS-08, that the symposium indeed provided ample opportunities to all participants of NLS-08 for fruitful interactions and exchange of ideas leading to furthering of their research interests, in the field of laser and laser applications.

FORTHCOMING CONFERENCE

Conference on Neutron Scattering and Mesoscopic Systems

The BRNS and UGC-DAE-CSR, in association with Indian Neutron Scattering Society and Goa University, have organized a 3-day conference, the 14th in the series, at the International Centre, Goa University, from Oct. 12-14, 2009. Prior to this conference, a "Pre-conference School on Neutrons as Probes of Condensed Matter" will be held from Oct. 5-10, 2009, at BARC, Mumbai.

In addition to basics in neutron scattering, other topics such as structural studies of crystalline, amorphous and magnetic materials using neutron diffraction, studies of dynamics in condensed matter using neutron inelastic and quasielastic scattering, applications of small-angle neutron scattering to soft-condensed matter, porous materials, nanomaterials, surface and interface studies on thin films and multilayers using neutron reflectometry, will be covered in the course of invited talks by experts and through poster sessions.

Abstracts on the above topics, prepared in MS-WORD can be submitted electronically to the Scientific Secretary, Dr. V.K. Aswal at cns09@barc.gov.in.

For further details one may contact :

Dr. R. Mukhopadhyay
Convener,
Solid State Physics Division,
BARC, Trombay, Mumbai - 400 085.
Tel. (O) : 022-2559 4667
E-mail : mukhop@barc.gov.in

Dr. S.M. Yusuf
Co-Convener
Solid State Physics Division,
BARC, Trombay, Mumbai - 400 085.
Tel. (O) : 022-2559 4306
E-mail : smyusuf@barc.gov.in

REMEMBERING DR. HOMI JEHANGIR BHABHA, THE PHYSICIST

A seminar "Remembering Dr. Homi Bhabha, the Physicist" was organized by BARC at the Central Complex Auditorium on March 30, 2009 as part of the Homi Bhabha Birth Centenary Celebrations. Dr. Homi Bhabha was a multifaceted personality, a physicist, an artist, a visionary and a builder of institutions. This seminar focused on one aspect of his towering personality, as one of the leading physicists of his times. A large number of scientists and engineers from DAE family attended the programme.

In the area of Physical Sciences, Dr. Bhabha is well known for his work on relativistic electron-positron scattering including exchange, better known as the 'Bhabha Scattering' and the Bhabha-Heitler theory of electromagnetic cosmic ray showers. Less well known is the fact, that he was the first to propose the existence of a heavier cousin of the electron, now known as the muon, to explain the penetrating component of cosmic ray secondary particles. This proposal was the first to enlarge the family of electron and its associated neutrino to suggest a member of what is now known as the second generation of leptons. He also coined (along with M. Price and N. Kremmer) the word 'meson' for the particle proposed by Yukawa for mediating the strong nuclear force between nucleons.

Dr. S. Banerjee, Director BARC delivering the welcome address


Prof. B.V. Sreekantan addressing the audience

In his welcome address, Dr. S. Banerjee, Director, BARC, elaborated the central idea behind holding this commemorative seminar. He hoped that this seminar will strengthen the spirit of inquiry, the passion for basic research and vibrancy of thoughts – the qualities epitomized by Dr. Bhabha.

Prof. B.V. Sreekantan releasing a book on Dr. Homi Bhabha

Prof. B.V. Sreekantan, former Director, TIFR, who obtained his Ph.D under Dr. Bhabha's guidance, gave a presentation on the life and work of Dr. Bhabha and the lessons he learned from Dr. Bhabha's life. He also released a book "Remembering Dr. Homi Bhabha, the Physicist". This book consists of articles on Dr. Bhabha's scientific contributions, his list of publications, an analysis of the impact of his scientific work, his famous quotations on the role of science & technology in the development of the country and also a photo album that shows Dr. Bhabha with leading physicists of his times. Copies of the book were provided to all participants of the seminar.

The seminar presented two of Dr. Bhabha's most celebrated pieces of work, Bhabha scattering and the Bhabha-Heitler theory of electromagnetic cosmic ray showers. These pedagogical lectures were presented, respectively, by Dr. A.K. Mohanty of Nuclear Physics Division and Dr. S. Bhattacharyya of Astrophysical Sciences Division. These works are very relevant even in modern times. For example, Bhabha scattering is routinely used to measure the luminosity in electron-positron collider experiments while the electromagnetic cascade theory forms the basis of modern electromagnetic calorimeters such as the lead tungstate based one in the Compact Muon Solenoid detector at the Large Hadron Collider at CERN.

The seminar concluded with the felicitation of the speakers, Prof. B.V. Sreekantan, Dr. A.K. Mohanty and Dr. S. Bhattacharyya, by Dr. S. Banerjee and a vote of thanks by Dr. S. Kailas, Associate Director, Physics Group (N).

PHYSICAL PROTECTION OF NUCLEAR MATERIALS AND FACILITIES : REPORT OF THE FIFTH REGIONAL TRAINING COURSE

The fifth Regional Training Course on Physical Protection of Nuclear Materials and Facilities was organized jointly by the Department of Atomic Energy, Government of India and IAEA during 6 – 17 April, 2009 at Navi Mumbai. The course was inaugurated by Mr. S K Chande, Vice Chairman, AERB.

There were 31 participants. Out of the 16 foreign participants; 6 were from Indonesia, 4 from Saudi Arabia, 1 each from Republic of Korea, Malaysia, Vietnam, Philippines, Sri Lanka and Egypt. There were 15 participants from India. Among the Indian participants, 4 were from BARC, 2 from AERB, 2 from IGCAR, Kalpakkam and 1 each from Kudankulam , Kaiga, RAPS, HWB, Mumbai, Ministry of Home Affairs (MHA) Delhi, NFC, ECIL. A total of 12 faculty members were involved in the deliberations. Among these 12 faculty members, 2 were from USA, one from IAEA staff member and one was from Netherlands, 8 faculty members from India were involved in this training course.

At the Inauguration Session - From left to right - Mr. G.P. Srivastava, Dir. E&I Grp. and Course Director, Mr. S.K. Chande, Vice Chairman, AERB, Mr. T.P. Das, IG, DAE, Mr. V. Kryuchenkov, IAEA

Group photograph of the participants and the faculty

This two-week course was arranged with 28 lecture sessions, 13 workgroup sessions and a field visit to a nuclear power station (TAPS 3 & 4). Wide ranging topics under nuclear security like Nuclear Fuel Cycle Activities and their physical protection concerns, Design Basis Threat (DBT), Design and evaluation of physical protection system, International Physical Protection Regime, IAEA activities in nuclear security etc. were covered in depth in this course. It also included several emerging areas of nuclear security like safety-security interface and security culture etc. Working group exercises were carefully designed to cover different aspects of designing of physical protection system for nuclear facilities including designing of sub-systems, evaluation and upgrade of design.

Two volumes of the course material containing about 1000 pages of the handouts of the presentations as well as the detailed lecture notes and a CD containing all the lecture notes and some important documents related to nuclear security provided by IAEA, were prepared for this course. The course was very well received by all participants and feedback from them was encouraging.

भा.प.अ.उें द्र के वैज्ञानिकों को सम्मान
BARC SCIENTISTS HONOURED


Dr. J.V. Yakhmi

डॉ. जे.वी.यख्मी को इज़राइल की प्रतिष्ठित लेडी डेविस ट्रस्ट फेलोशिप अवार्ड पुरस्कार से सम्मानित किया गया है। इस पुरस्कार के अनुसार इन्हें मार्च-मई 2009 के दौरान, दो महीने रेहोवॅट के वैइज़मान इंस्टिट्यूट ऑफ साइंस, और हाइफा में तचनियो के इज़राइल इंस्टिट्यूट ऑफ टेक्नॉलोजी में अतिथि प्राध्यापक की हेसियत से कार्य करना है।

डॉ. जे.वी.यखमी, सह निदेशक भौतिकी वर्ग तथा अध्यक्ष, तकनीकी भौतिकी एवं प्रोटोटाइप इंजीनियरी प्रभाग, ने भाभा परमाणु अनुसंधान केंद्र में पिछले 39 वर्षों से पदार्थ विज्ञान में भिन्न-भिन्न प्रकार के अनुसंधान क्षेत्रों जैसे हाई टीसी सुपरकंडक्टर्स, मेग्नेटिक एल्लोइज़, मॉलिक्यूलर पदार्थ पर काम किया। मॉलिक्यूलर इलेक्ट्रानिक्स एवं बयो-सेंसर्स के क्षेत्र में इनका योगदान अंतराष्ट्रीय स्तर पर मान्य है।

Dr. J.V. Yakhmi has been awarded the prestigious Lady Davis Trust Fellowship of Israel. Under this, he is to spend 2 months as a Visiting Professor at the Weizmann Institute of Science at Rehovot and at Technion (Israel Institute of Technology) at Haifa during March-May 2009.

Dr. J.V. Yakhmi, Associate Director (S) Physics Group and Head, Technical Physics and Prototype Engineering Division, has worked in BARC for the past 39 years, on diverse areas of research in materials science, such as high-Tc superconductors, magnetic alloys, molecular materials etc. His contributions to the field of molecular electronics and bio-sensors are internationally recognized.

सुनीता केडिया, आर. विजया, आलोक. के. रे तथा सुचरिता सिंहा द्वारा लिखा हुआ "इफेक्ट ऑफ फोटोनिक स्टोपबेंड ऑन दि एमिशन ऑफ रोडामाइन डाई" नामक शोध-पत्र को जनवरी 7-10, 2009 के दौरान आयोजित "डीएई-बीआरएनएस नैशनल लेज़र के आठवें सिंपोज़ियम में सर्वश्रेष्ठ शोध-पत्र पुरस्कार से सम्मानित किया गया था।

"Effect of photonic stopband on the emission of Rhodamine dye" authored by Sunita Kedia, R. Vijaya, A.K. Ray and Sucharita Sinha, was given the Best Paper Award at the 8th DAE-BRNS National Laser Symposium held during 7-10 Jan, 2009.


Dr. Alok Ray

डॉ.आलोक रे ने प्रशिक्षण केंद्र के 26वें बैच (रसायनिकी) से स्नातकता प्राप्त करने के पश्चात भाभा परमाणु अनुसंधान केंद्र के एल एंड पीटीडी में कार्यभार संभाला। इन्होंने वर्ष 1992 में मुंबई विश्वविद्यालय से पीएच.डी की डिग्री प्राप्त करके यूरेनियम एटम एवं आयोडीन के लेज़र फोटो आयोनाइज़ेशन स्पेक्ट्रोस्कोपी पर काम किया तत्पश्चात् सीएनआरएस, फ्रांस में स्नातकता प्राप्त की। ये एचबीएनआइ में पीएच.डी निर्देशक एवं रसायन के प्राध्यापक हैं। आप डिफेन्स इंस्टिट्यूट ऑफ एडवान्स टेक्नॉलोजी डीआरडीओ में एम टेक (लेज़र एन्ड इलेक्ट्रो ऑप्टिक्स) पाठ्यक्रम तथा पूणे विश्वविद्यालय, पूणे, के एम.एससी (रसायन) छात्रों के अतिथि प्राध्यापक हैं। इनकी वर्तमान रुचि के क्षेत्र में भैतिक-रसायन फोटो एवं उच्च ऊ र्जा डाई लेजर रंजक का विकास एवं उत्तेजित फोटो रसायनिक एकांकी-फोटॉन आइसोटोप का अलगाव तकनीक का प्रयोगशाला-स्तर का प्रदर्शन हेतु वैज्ञानिक संभाव्यता को लेकर चलना शामिल है।

Dr. Alok Ray joined L&PTD, BARC after graduating from the 26th batch (Chemistry) of Training School. He completed his Ph.D. from the University of Mumbai in 1992 for his work on laser photoionization spectroscopy of uranium atom and iodine molecule and did his Post Doctoral research at CNRS, France. He is a PhD guide and Professor of Chemistry at the HBNI. He has been serving as a visiting lecturer for M. Tech (Laser & Electro Optics) course at Defence Institute of Advanced Technology, DRDO and M. Sc. (Chemistry) students at University of Pune, Pune. His present field of interests include photo physical-chemical & laser characterization of advanced dyes, development of high power dye lasers and carrying out scientific feasibility studies for lab-scale demonstration of single-photon excited photochemical isotope separation technique.


Dr. Sucharita Sinha

डॉ. श्रीमती सुचरिता सिंहा, भाभा परमाणु केंद्र के प्रशिक्षण केंद्र के 26वें बैच से होमी भाभा पुरस्कार की प्राप्तकर्त्ता हैं। इन्होंने लेज़र-परमाणु अंतर्व्यवहार में सैद्धांतिक एवं प्रायोगिक अनुसंधान से शक्तिशाली लेज़र किरणों की गुणवत्ता को बढाने हेतु नवीन आकर्षक उपायों का विकास किया। आरआइएस कार्यक्रम में इनके अनुसंधान के नतीजों को सफलता पूर्वक अमल में लाया गया है जिसके कारण लेज़र प्रणाली में प्रगति हुई। वर्ष 1990 में इन्होंने ऑप्टिक्ली पम्पड मोलिक्यूलर गेस लेजर्स पर काम के लिए मुंबई विश्वविद्यालय से भैतिक विज्ञान में पीएच.डी की डिग्री प्राप्त की। संयोजित पदार्थों अर्धचालक नेनोस्फियर्स में क्वांटम साइज ईफेक्टस् का सैद्धांतिक विश्लेषण पर इनका कार्य साहित्य में साइट किया जाता है।

कई अन्य वर्तमान लेज़र पदार्थ अपक्षरण प्रणाली की अनुसंधान रुचियों में इन्होंने नाभिकीय ईंधन पैलेट के एक आवश्यक धातुचित्रण परीक्षण हेतु अनुपम निर्जल निक्षारण तकनीक का भी प्रदर्शन किया है। पहली बार डॉ. सिन्हा विशाल प्रगतिशील क्षेत्र-निस्सारण गुणों को प्रेरित करके इलेक्ट्रॉन के पीकोसेकंड लेज़र आधारित सतही मेक्रो-रचनागत का प्रदर्शन करने में सक्षम रहीं हैं।

प्रकाशनों के आधार पर डॉ. सिन्हा को कई प्रसिद्ध पत्रिकाओं जैसे अमेरिकन इन्स्टिट्यूट ऑफ फिज़िक्स, ऑप्टिक्ल सोसाइटी ऑफ अमेरिका एवं इंडियन अकादमी ऑफ साइन्सिस के समीक्षक के पद पर नामान्कित किया गया। इन्हें वर्ष 2006 के होमी भाभा साइन्स एन्ड टेक्नॉलोजी पुरस्कार से भी सम्मानित किया गया।

Dr. Ms. Sucharita Sinha, is a Homi Bhabha awardee of the 26th batch of BARC Training School. She has carried out extensive theoretical and experimental investigations on nonlinear optical phenomena in laser-atom interaction, photo-thermal properties of tunable-laser media and developed novel attractive means to improve the quality of high-average-power laser beams. The output from her research has been successfully implemented in the RIS program, resulting in improved performance of the laser systems. She received her Ph.D degree in Physics from Mumbai University in 1990 for her work on Optically Pumped Molecular Gas Lasers. Her work on theoretical analysis of quantum size effects in composite materials and semiconductor nanospheres, resulting in tailored optical absorption spectrum, is widely cited in literature.

Among her current research interests in the field of laser material ablation process, she has demonstrated a unique dry laser etching technique, required for metallographic examination of nuclear fuel pellets. For the first time, Dr. Sinha has been able to demonstrate, picosecond laser-based surface micro-structuring of electron emitters, leading to vastly improved field-emission properties.

Based on her publications Dr. Sinha has been

nominated reviewer for several reputed journals, viz., American Institute of Physics, Optical Society of America and Indian Academy of Sciences. She has been awarded the Homi Bhabha Science and Technology Award for the year 2006.

निहारिका सिंह, वाई.बी.काले, ऑयन रे एवं बी.एन. जगताप को मार्च 23-25, 2009 के दौरान अल्लाहाबाद विश्वविद्यालय में आयोजित ''इमरजिंग ट्रेंडस इन लेज़रस एन्ड स्पेक्ट्रोस्कोपी एन्ड एप्लिकेशन्ज़'' पर मेधनंद साहा मेमोरियल सिम्पोज़ियम में प्रोफेसर एन.के.एस. गौर श्रेष्ठ पोस्टर पुरस्कार से सम्मानित किये गया।

A paper entitled "Spectroscopy in a coherently prepared atomic medium" by Niharika Singh, Y.B. Kale, Ayan Ray and B.N. Jagatap, received the Prof. N.K.S. Gaur Best Poster Award in the Meghnand Saha Memorial Symposium on Emerging Trends in Lasers & Spectroscopy and Applications, held at Allahabad University during March 23-25, 2009.


Dr. Ayan Ray

डॉ. आयन रे, ने डॉ. के.एस. कृष्णन सहायक कार्यक्रम के 13वें बैच से वर्ष 2006 में लेज़र एन्ड प्लाज़मा टेक्नॉलोजी प्रभाग में कार्यभार संभाला। इन्होंने वर्ष 2005 में कलकत्ता विश्वविद्यालय से पीएचडी प्राप्त किया। इनकी अनुसंधान रुचि के क्षेत्र में मुख्यत: सेमिकंडक्टर डाइयोड लेज़र के साथ अल्ट्रा-प्रिसिजन स्पक्ट्रोस्कोपी एवं मेट्रोलोजी भी शामिल है।

Dr. Ayan Ray is from the 13th batch of Dr. K.S. Krishnan Associateship Programme and he joined the Laser & Plasma Technology Division in 2006. He obtained his Ph.D. from the University of Calcutta in 2005. His main area of research includes ultra-precision spectroscopy and metrology with semiconductor diode laser.


Dr. B.N. Jagtap

डॉ. बी.एन. जगताप लेज़र एन्ड प्लाज़मा टेक्नॉलोजी प्रभाग के एक उत्कृष्ट वैज्ञानिक हैं।

Dr. B.N. Jagatap is an Outstanding Scientist in the Laser & Plasma Technology Division.

बी.पी. मंडल, वी. ग्रोवर, एम.आर.पई, एवं ए.के. त्यागी द्वारा लिखित ''इन्फलूअन्स ऑफ एच$_2$ओ$_2$ ऑन फिसिको-केमिकल प्रोपरटीज़: ए केस स्टडी ऑन डोप्ड सीरिया सिस्टम'' नामक शोध-पत्र को 2-6, दिसंबर, 2008 के दोरान हाल में ही भाभा परमाणु अनुसंधान केंद्र में आयोजित पदार्थ रसायन की द्वितीय डीएई बीआरएनएस की अंतर्राष्ट्रीय परिचर्चा में सर्वश्रेष्ठ पोस्टर पुरस्कार प्रदान किया गया।

Recently, a paper entitled "Influence of H_2O_2 on physico-chemical properties: a case study on doped ceria System" authored by B. P. Mandal, V. Grover, M. R. Pai and A. K. Tyagi won one of the Best Poster awards at the 2nd DAE-BRNS International Symposium on Materials Chemistry, held at BARC during Dec. 2-6, 2008.


Mr. Balaji P. Mandal

श्री बालाजी पी. मंडल ने भाभा परमाणु अनुसंधान केंद्र के प्रशिक्षण केंद्र के 47वें बैच से रसायन प्रभाग में कार्यभार संभाला। इनके अनुसंधान रुचि के क्षेत्र में मिश्रित आक्साइड एवं प्रतिदीप्ति पर आधारित रचनागत खनिज पदार्थों के संयोजन तथा स्पष्टीकरण शामिल है। इन्होंने रचनागत- गुण के पारस्परिक संबंध निर्देशों से अनेक नये कंडक्टरों का निर्माण किया।

Mr. Balaji P. Mandal joined the Chemistry Division, BARC from 47th batch of Training School. His research interests are in the field of synthesis and structural elucidation of inorganic materials based on mixed oxides and fluorides. He has prepared several new ionic conductors as guided by structure-property correlation.


Dr. Vinita Gupta

डॉ.(श्रीमती) विनीता ग्रोवर गुप्ता ने भाभा परमाणु अनुसंधान केंद्र के प्रशिक्षण केंद्र के 44वें बैच से रसायन प्रभाग में कार्यभार संभाला। इन्हें मुंबई विश्वविद्यालय के द्वारा अक्रिय मैट्रिक्स ईंधन पर कार्य संपन्नता को मान्यता देने हेतु रसायन विज्ञान में पीएच.डी.की पदवी देकर सम्मानित किया गया। हाल में ही आपने फल्यूराइड प्रणाली में ऑप्टिक्ल पदार्थ पर अनुसंधान की पहल की। आप आईयूपीएसी यंग केमिस्ट अवार्ड (युवा रसायनज्ञ पुरस्कार) की विजेता भी हैं।

Dr. (Ms.) Vinita Grover Gupta joined the Chemistry Division, BARC from 44th batch of Training School. She was awarded the Ph.D. degree (Chemistry) in 2006 by Mumbai University, in recognition of her work on Inert Matrix Fuels. Recently, she has initiated research on optical materials in fluoride systems. She is a winner of the IUPAC Young Chemist Award.


Dr. Mrinal Pai

डॉ.(श्रीमती) मृणाल आर. पई ने भाभा परमाणु अनुसंधान केंद्र में प्रशिक्षण केंद्र 40वें बैच से भाभा परमाणु अनुसंधान केंद्र में कार्यभार संभाला। आरंभ में इन्होंने एच$_2$ उप्रेरक मिश्रण के विकास पर काम किया। इस समय फोटो केटेलिसिज़ एवं I-S थरमोकेमिक्ल साइक्ल में सल्फ्यूरिक एसिड विघटन की प्रतिक्रिया पर कार्यरत हैं। इन्हें वर्ष 2005 में मुंबई विश्वविद्यालय के द्वारा पीएच.डी (रसाय-न) की पदवी प्रदा-न की गई। आप टीए इ-सट्रूमेंटस आइटीएएस-यंग सांइटिस्ट अवार्ड (युवा वैज्ञानि-क पुरस्का-र-2008) की भी प्राप्तकर्ता हैं।

Dr. (Ms.) Mrinal R. Pai joined BARC from the 40th batch of Training School. Initially she worked on the development of H_2 mitigation catalyst. Current she is working on water splitting by photocatalysis and sulfuric acid decomposition reaction in I-S thermochemical cycle. She was awarded Ph.D. degree (Chemistry) from Mumbai University in 2005. She is a recipient of TA instruments ITAS- Young Scientist Award -2008.


Dr. A.K. Tyagi

डॉ.ए.के. त्यागी, ठोस अवस्था रसायनिक अनुभाग अध्यक्ष, ने भाभा परमाणु अनुसंधान केंद्र के प्रशिक्षण केंद्र के 29वें बैच से भाभा परमाणु अनुसंधान केंद्र में कार्यभार संभाला। तत्पश्चात् इन्होंने विस्तृत श्रेणी के रसायन पदार्थों पर काम किया। आप अनेक प्रतिष्ठित पुरस्कारों के प्राप्तकर्ता हैं तथा मुंबई विश्वविद्यालय एवं होमी भाभा नैशनल इंस्टिट्यूट (एचबीएनआइ) के एक मान्यता प्राप्त निर्देशक हैं।

Dr. A. K. Tyagi, presently Head, Solid State Chemistry Section, joined the Chemistry Division, from 29th batch of Training School. Since then he has been working in the field of Chemistry of a wide range ofmaterials. He is a recipient of several prestigious awards. He is a recognized Ph.D. guide of Mumbai University and of Homi Bhabha National Institute (HBNI).

6-10 जनवरी के दौरान एलएएसटीईसी, नई दिल्ली में आयोजित नैशनल लेज़र परिचर्चा में डॉ सौमन भट्टाचार्या द्वारा पी एच डी हेतु मुंबई विश्वविद्यालय में प्रस्तुत थीसिस "स्टडी ऑफ ऑटोआयोनाइज़ेशन एन्ड रैडबर्ग स्टेटस ऑफ


Dr. S. Bhattacharyya

यूरोपियम एटम बई लेज़र फोटो आयोनाइज़ेशन स्पेक्ट्रासकोपी'' को इन्डियन लेजर एसोसियेशन ने सर्व श्रेष्ठ थीसिस की मान्यता दी है।

डॉ भट्टाचार्या ने भाभा परमाणु अनुसंधान केंद्र के प्रशिक्षण केंद्र के 41वें बैच से स्नातकता प्राप्त की है। वर्ष 1998 में स्पेक्ट्रोस्कोपी प्रभाग का कार्यभार संभालने के उपरांत आप लेज़र स्पेक्ट्रोस्कोपी के क्षेत्र में काम करतें रहे। इनके महत्वपूर्ण योगदान में स्पेक्ट्रोस्कोपी के परमाणुओं के उच्च निर्धारण हेतु एक आण्विक किरण सुविधा की स्थापना, आण्विक, बीम, आण्विक एन्ड युरोपियम जैसे रिद्धभर्ग श्रंखला डाटा का भाषांतरण हेतु बहु साधन अल्पतम साधन का उपयोग भी शामिल है।

A thesis entitled "Study of Autoionization and Rydberg States of Europium Atom by Laser Photoionisation Spectroscopy" submitted by Dr. Soumen Bhattacharyya to Mumbai University for award of Ph.D. degree was adjudged as the Best Thesis by Indian Laser Association during the National Laser Symposium held at LASTEC, New Delhi, January 6-10, 2009.

Dr. Bhattacharyya is a graduate of the 41st Batch of BARC Training School. Since he joined the Spectroscopy Division in the year 1998, he has been working in the area of laser spectroscopy. Among his notable contributions are the setting up of a molecular beam facility for high resolution specroscopy of atoms, molecules, clusters and the application of multichannel Quantum Defect Theropy to interupt Rydburg series data of complicated atom like europium.

Forthcoming Conference

DAE Solid State Physics Symposium
(DAE-SSPS 2009)

The DAE-BRNS sponsored symposium, the 54th in the series, will be held at the M.S. University of Baroda, Vadodara, from December 14-18, 2009. The scientific programme of the symposium will comprise invited talks, seminars, Ph.D. thesis presentations and contributed papers in the form of posters on the following range of topics.

a. Phase transitions
b. Soft condensed Matter including Biological Systems & Liquid Crystals
c. Nanomaterials
d. Experimental Techniques & Devices
e. Liquids, Glasses & Amorphous Systems
f. Surfaces, Interfaces & Thin Films
g. Electronic Structure & Phonons
h. Superconductivity
i. Transport properties
j. Semiconductor Physics
k. Magnetism including Spintronics
l. Novel Materials

Young Achiever Awards (YAA), Ph.D. Thesis Awards, M.Sc. Project Awards and Poster Awards have been instituted as part of the symposium. Manuscripts can be submitted by email at pap-ssps@barc.gov.in

Important Dates

Paper submission	:	25th August 2009
Registration	:	3rd November 2009
Accommodation	:	3rd November 2009

For more information please contact

Dr. G.P. Kothiyal
Convener, 54th DAE-SSPS-09
Head, Glass and Ceramic Technology Section &
Professor, Homi Bhabha National Institute
TPPED, BARC, Trombay, Mumbai -400085, India
Fax : 9122-25505296, 25505151
Phone : 9122-25595652

Portrait sketched by Dr. Homi J. Bhabha

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