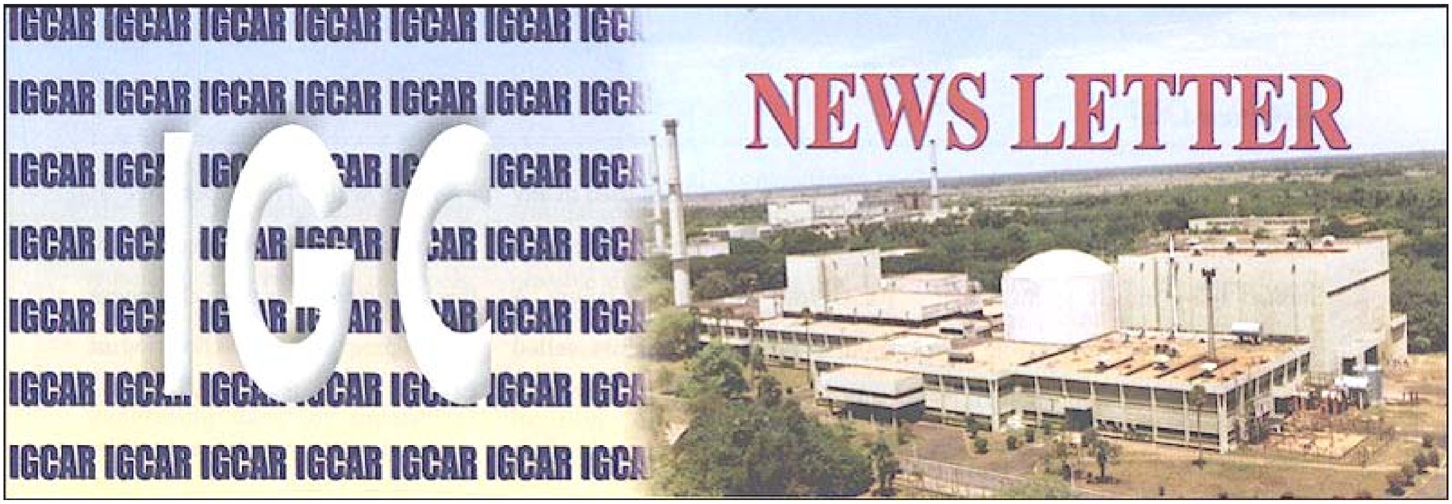

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Vol.57
JULY 2003

INSIDE THE NEWSLETTER

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From the Director's Desk

Closing of Fuel Cycle in FBR

The fuel used in FBR i.e. Plutonium is produced in thermal reactors. The breeder converts the abundant isotope U^{238} to PU^{239} and thus becomes an energy amplifier, by a factor of over 100. The discharged fuel from the FBR is reprocessed and put back in the reactor. The total inventory of Pu in the cycle needs to be kept to minimum in order to shorten the fuel doubling time for faster growth of FBR. Reprocessing of FBR fuel is much more challenging than the thermal reactor fuel because of (a) high concentration of Pu (15-30%), (b) higher radioactivity of the fission products due to very high bum up in the reactor, (c) need to reduce heavy metal losses in the cycle and (d) economic processing to reduce the kWh cost from FBR. For the breeder system the capital cost of the reactor would be 10-20% more than a PWR, but the fuelling cost would be about half that of PWR. This is due to the very high bum up in breeder (200 GWd/t) compared to PWR (40 GWd/t).

Globally the technology of reprocessing the breeder fuel is very limited and is mostly on MOX fuel Dem onstration of repro-cessing of 4 months cooled MOX fuel, with 0.1 % heavy metal loss has been demonstrated at Dounreay, in UK. In India, IGCAR carried out the process and equipment development during last two decades. The fuel used in FBTR is mixed carbide of Pu and natural U (70% PuC + 30% UC). Such a fuel has not been used in any reactor .The fuel burn up has reached 100 GWd/t without any failure. A small experimental facility called Lead Mini Cell (LMC) has been set up at IGCAR to reprocess this fuel. The commissioning trials were carried out during the year and Pu has been charged into the system in June 2003.

Worldwide there is no experience of reprocessing any carbide fuel on even kg scale. The experience at Kalpakkam will go a long way in this technology. The main challenges in this programme are chopping of 55 clad fuel, dissolution in nitric acid, removal of organic compounds, separation of Pu and U. We will be able provide more details by the end of 2003, when fuel subassemblies would have been repro-cessed. This milestone is very important in the country's breeder programme.

(S.B. Bhoje)
Director, IGCAR

Commissioning of 1/4 Scale Thermal-hydraulic Model of Primary Circuit of PFBR

The Scale Model for Reactor Thermal Hydraulics is a one fourth scaled down model of the Reactor Assembly of PFBR. The model would be a permanent facility and is planned to be utilized even during PFBR operations to examine any new phenomenon that one comes across. This test facility would be used to conduct various thermal hydraulic and flow induced vibration studies. Fig. 1 shows the schematic of the model and Fig. 2 shows the top view of the same.

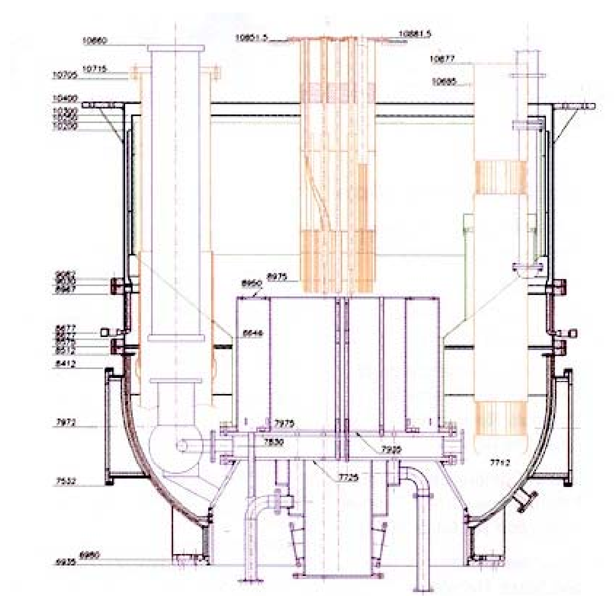


Fig.1 Schematic of the Model

Thermal hydraulic studies were carried out earlier on a 1/24 scale model at Engineering Development group, IGCAR and on a 1/15 scale model at Central Water Power Research Station, Pune. Flew induced vibration of thermal baffles were studied on a 1/16 scaled model at EDG. However, these models were simulating the 4 loop design. The 1/24 scale model simulated only the hot pool while the 1/15 scale model simulated both hot and cold pools. The core was simulated by orifices and total flow rate was maintained. These models were useful in generating data for theoretical analysis and code validation.

The model simulates the present 2 loop design and hence is more representative than the earlier models. Due to the large size of this model, better simulation of geometrical details are achieved. The fuel, blanket, storage and cavity zones are simulated in the model. Fuel S/ A 's are simulated with sleeves and electrical heaters placed inside the sleeves to simulate decay heat generation for natural convection experiments. Inter-wrapper space which plays a major role in natural convection is simulated. For FIV experiments, better simulation is rendered possible due to larger size and the results are directly transposable to the reactor. The scope of studies include Determination of optimum location of core monitoring thermocouples, Thermal striping studies on control plug. Simulation in IHX during secondary pump trip. Decay heat removal by natural convection and FIV of control plug, inner vessel and thermal baffles.
Flow pattern, temperature profile, free level fluctuation, gas entrainment, thermal stratification and weir instability measurements were determined using the earlier models, however, the larger model reduces the scale effects and better simulation of all forces are maintained.

Studies in the model are conducted using water as the simulant fluid. To circulate water through the model for various studies, the water loop has been commissioned along with model. The flow rate and temperature of water to be circulated is decided based on the similarity criteria for each experiment. The water loop comprises of six centrifugal pumps coupled to electric motors of which 2 are 6.6 kV A motors. There are two plate type heat exchangers of 500 kW rating and a cooling tower to remove 1 MWt heat. The loop is designed so as to cater to the various studies with flow control possible by means of pneumatically actuated valves.

(G. Padmakumar. K.Rajesh and V. Prakash)

Fig.2: Top view of the model showing the control plug, IHX and DHX positioned in the hot pool

An Improved Method for Estimation of Delta-ferrite Content in Stainless Steel Welds using Bayesian Neural Network Analysis

Austenitic stainless steels are an important class of materials in energy-related systems, and are the preferred structural materials for sodium-cooled fast breeder reactors as they meet the stringent requirements for nuclear reactor service. A nitrogen-added low-carbon version of AISI type 316L austenitic stainless steel, designated as 316LN 55, has been chosen for the high-temperature components of PFBR. A major consideration during fabrication of 316LN 55 is its resistance to hot cracking during fusion welding. The presence of delta-ferrite in the austenitic weld metal promotes its hot-cracking resistance. To achieve the desired ferrite content, it is necessary to control the chemical composition of the weld metal in such a way that the resultant weld has a duplex austenitic-ferritic structure. However, this duplex microstructure is highly unstable during high temperature service as delta-ferrite transforms to carbides and brittle intermetallic phases, e.g. sigma phase. Consequently, the tensile, impact toughness, fatigue and creep properties of the weld metal are significantly influenced by the kinetics as well as the nature of the delta-ferrite transformation, which in turn strongly depend on the chemical composition of the weld deposit. The duplex micro-structure may also influence the magnitude and/or distribution of residual stresses. Thus, the amount of delta-ferrite considerably influences the mechanical properties in this type of steels. Proper control of the amount of delta-ferrite to within 3-10% in these welds may also improve their ductility, toughness, corrosion resistance, mechanical properties and behaviour of the weld metal during welding including hot cracking.

As matching composition welding consumables are to be used for welding 316LN SS for the FBR, ferrite number (FN) has been included in the specification for 316LN SS welding consumable to ensure that weldments contain a desired amount of ferrite. The composition of 316LN SS consumable is optimized during consumable manufacture based on the estimated delta-ferrite content achievable in the weld as predicted by the WRC-1992 diagram, which is claimed to be most accurate diagram to date. The Cr_{eq} and Ni_{eq} formulae used for generating the WRC-1992 diagram is given by: Cr_{eq} = Cr+ Mo + 0.7Nb and Ni_{eq} = Ni + 35C + 20N + 0.25Cu. The limitation of these equations is that values of the coefficients for the different elements remain unchanged irrespective of the change in the base composition of the weld metal. However, the relative influence of each alloying addition given by the elemental coefficients in the Cr_{eq} and Ni_{eq} expressions is likely to change over the full composition range. Furthermore, these expressions ignore the interaction between the various alloying elements. Also, there are a number of alloying elements that have not been considered in the WRC-1992 diagram. Elements like Si, Ti, W have not been given due considerations, though they are known to influence the ferrite content. Hence, the ferrite content estimated using the WRC-1992 diagram would always be less accurate and may never be close to the actual measured value. Hence, the prediction and measurement of FN in stainless steels welds remains of scientific interest due to the limitations involved in all the current methods.

Bayesian neural network (BNN) analysis, which overcomes the over-fitting of the training data, has been used to develop an improved method for estimating the ferrite number in stainless steel welds. The predictions of the Bayesian neural network are accompanied by error-bars, and the significance of each input variable is automatically quantified in this type of analysis. The Bayesian framework uses a committee of models for generalization rather than a single model,

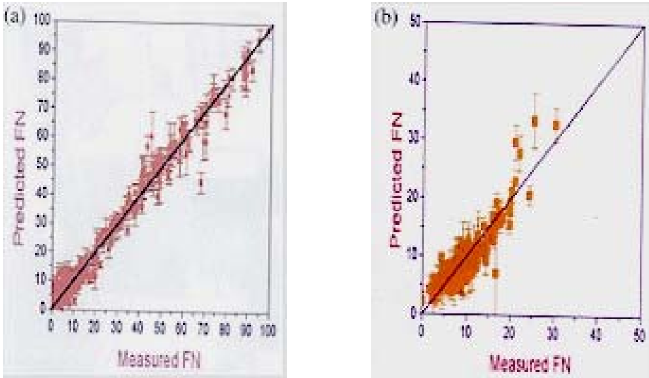


Fig.1: Comparison between measured and predicted FN values for (a) entire dataset with the RMS error being 2.1; and (b) Independent dataset not used in training, the RMS error being 2.03.

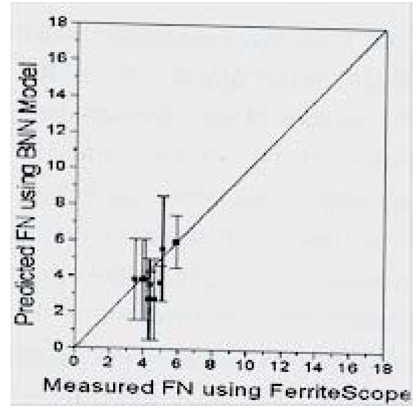


Fig.2: Comparison of Ferritescope measured and BNN model estimated FN values for welds of the indigenously developed E316-15 electrodes

and the best models are ranked based on maximum in the logarithmic predictive error. The optimised committee model estimates the ferrite number in stainless steel welds with much better accuracy than the constitution diagrams and the other currently available FN estimation methods. Excellent agreement over the entire datasets has been obtained between the predicted and measured FN values for the committee of models (Fig. 1a), with a correlation coefficient of 0.97623. The RMS value estimated was 2.1, Figure 1(b) shows the comparison between the measured and predicted FN for an independent data set consisting of 263 data not used in the training. The RMS value estimated was 2.03, and has been observed to be much superior to the other FN prediction methods. It was found that the present model is 64% more accurate than the WRC-1992 diagram and 40% more accurate than the FNN-1999 model in estimating the ferrite number, It has been found that the change in FN is a non-linear function of the variation in the concentration of the elements. Analysis using this in-house developed method has brought out clearly the fact that individual element contributions to ferrite number vary depending on the base composition of the weld metal.

This BNN model was used for estimating the delta-ferrite content from the chemical composition of the welds deposited using the modified E316-15 electrodes that have been indigenously developed as per PFBR specifications. Figure 2 shows close agreement between Ferritescope measured and BNN model estimated FN values, with the estimated values having a maximum absolute error of 1.8 and mean error of 0.67.

The generalized Bayesian Neural Network (BNN) model for estimating the ferrite number in austenitic stainless steel welds has been demonstrated to be superior to all the presently available ferrite number estimation methods, viz. the WRC-1992 constitution diagram (which in turn is superior to the Schaeffler and Delong constitution diagrams), the Function Fit model and the FNN-1999 model. This BNN model also clearly brings out the significance of the individual alloying elements in austenitic stainless steel welds on the ferrite number.

(M. Vasudevan, A.K. Bhaduri and Baldev Raj)

1.7 MV Tandetron Accelerator at MSD: Commissioning and Setting Up of Experimental Facilities

Low energy accelerators at the Particle Irradiation Facility (PIF), Materials Science Division, have been extensively used over the years for carrying out research in various areas including, ion beam synthesis of novel materials, radiation induced phase instabilities, irradiation effects in semiconductors and behavior of implanted gases in metals. In order to enhance the scope of the research activities using accelerators and specifically to carry out implantation/ irradiation studies requiring high beam current and heavy ions, a 1.7 MV tandetron accelerator was procured from High Voltage Engineering Europa, Netherlands, towards the end of the 9^{th} plan. Charged particle simulation of void swelling in fast reactor structural materials is identified as one of the thrust areas of investigation, using this accelerator. This accelerator has the "tandem" configuration where negative ions generated by an ion source are first accelerated to the high voltage terminal and subsequently, the negative ion are converted to positive ions, while passing through a stripper canal filled with nitrogen gas. The same high voltage again accelerates the positive ions to ground potential. In addition to the advantage of using the same high voltage for accelerating the ions twice, the configuration has the added advantage that both the ion injection system and the target are at ground potential.

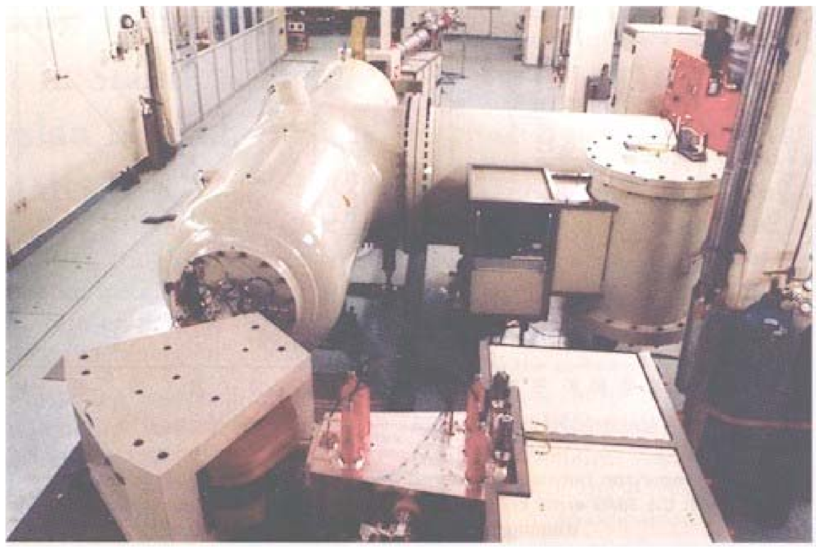


Fig.1 Overall view of the 1.7 MV Tandetron Accelerator

The beam injection system of the accelerator has two ion sources (i) a high brightness duo-plasmatron ion source for the production of H^- and He^- ions and (ii) a sputter source (SNICS) capable of producing negative ions of almost all elements.

A 900 mass analyzing magnet with a resolution (m/ Δm) of 190 facilitates the injection of the ion beams from either of the sources into the accelerator. The entire accelerating structure consisting of the accelerating tubes, the high voltage terminal and the power supply are enclosed in a pressure vessel filled with SF_6 gas at 6 Kg/cm^2 for achieving high voltage insulation. The Crockroft - Walton type solid-state power supply used for the generation of the high voltage allows the variation of the terminal voltage from 100 kV to 1.7 MV with a high stability of +/_100 Volts. The accelerating tubes are maintained at a vacuum of 10^{-7}mbar and a turbo molecular pump has been installed at the high voltage terminal for the recirculation of the stripper gas. The accelerated ions emerging on the high energy side of the machine are focused by an electrostatic quadrupole lens. The high energy switching magnet selects the charge state of the ions and switches the beam to experimental ports located at $\pm 10^{o}$ and $\pm 30^{o}$ angular positions. An implantation beam line complete with beam sweep system, neutral trap, beam profile monitor and retractable slits for beam collimation has been installed at the 10^{o} port of the switching magnet. The accelerator can produce intense (several micro amps) beams of practically all ions, with the exception of heavier noble gas ions. The maximum energy achievable is decided by the charge state of the ions at the terminal after stripping. For a wide range of elements, positive ions of charge state up to +3 can be produced, with reasonable intensity during stripping, resulting in a maximum beam energy of 6.8 MeV. The minimum energy of operation is 200 KeV, mainly decided by the stability of the high voltage and ion optics at low terminal voltages. The accelerator has been installed and commi-ssioned at the Particle irradiation facility of MSD and figure 1 shows a photograph of the accelerator.

Due to its versatile nature, the accelerator can be used for several applications ranging from ion implantation, ion irradiation and ion beam analysis using techniques like Rutherford Backscattering Spectroscopy (RBS), ion channeling, Particle Induced X-ray Emission (PIXE) and Nuclear Reaction Analysis. Light ions like H and He find application in ion beam analysis whereas irradiation with heavy ions like Ni can result in high damage production rates (10-2 dpa/ sec) and can be used for the simulation of fast neutron damage in reactor structural materials. With such high dose rate, ion simulation of fast neutron damage in the high dpa regime up to 150 dpa is achievable in a short duration.

An UHV compatible irradiation chamber for carrying out ion irradiation, ion implantation and ion beam analysis work has been designed and fabricated indigenously. It was tested and found to sustain a vacuum of 10^{-8} mbar and this was installed in beam line. The chamber and the associated beam line instrumentation for high temperature irradiation, RBS and ion channeling studies have been successfully tested and figure 2 shows a photograph of the irradiation chamber. After reproducing various benchmark tests and detailed studies, RBS experiments are being carried out routinely. Figure 3 shows an example of RBS spectrum obtained using the

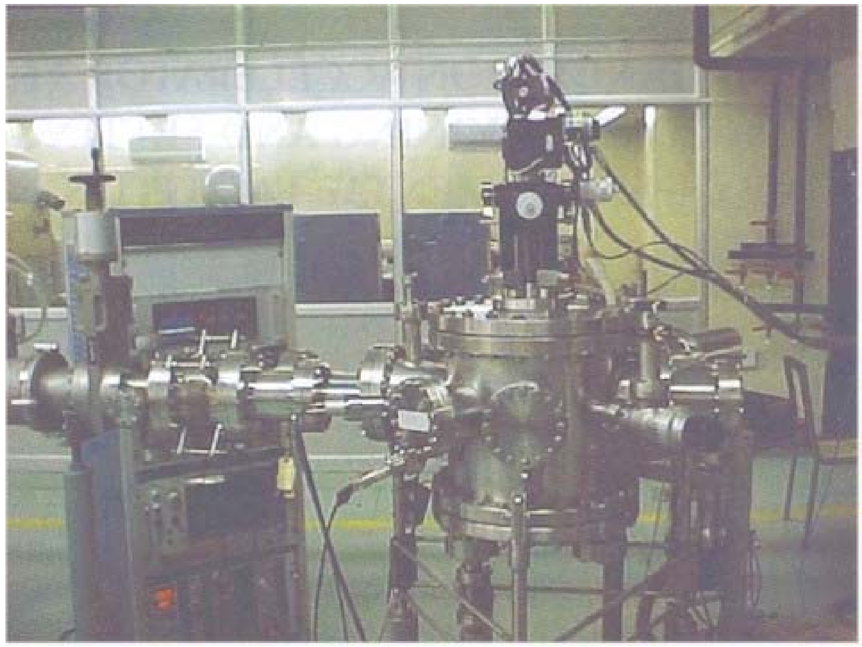


Fig. 2 The UHV target chamber attached to the beam line of the accelerator, which is used for irradiation, RBS and channeling experiments.

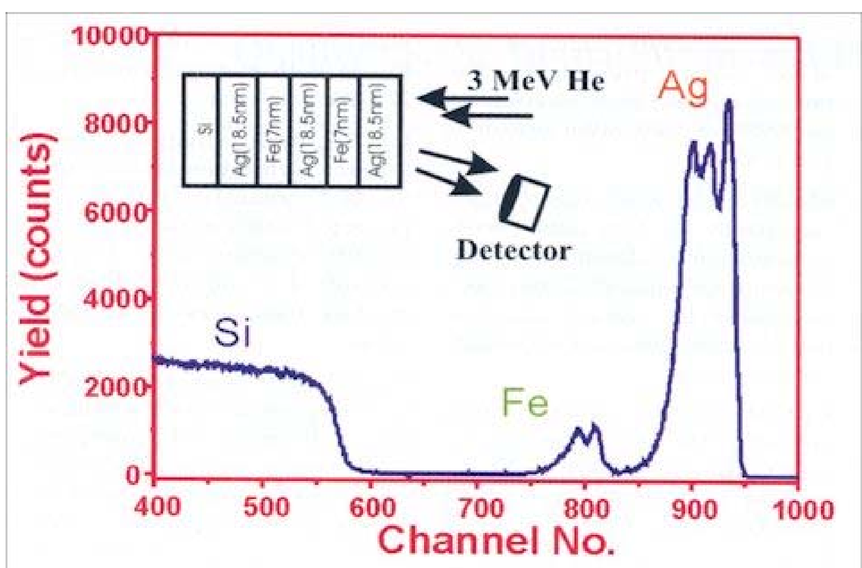


Fig. 3: RBS spectrum of an Ag/Fe Multilayer taken in the Glancing incidence geometry. Peaks due to Ag and Fe are clearly resolved in the spectrum.

present set up. The sample is a multilayer Ag and Fe system coated on to Si substrate and this has been studied by RBS, using 3 MeV He ions. A schematic of the multilayer sample, experimental geometry and the recorded spectrum are shown in the figure. Clear signals due to Ag and Fe layers are seen in the spectrum. Apart from this, beams of H, He, Ni, Co and Au have been accelerated and used for experiments involving ion beam analysis and ion implantation. Studies on simulation of void swelling in D9 alloy using Ni ions from the accelerator have been initiated.

(K.G.M. Nair, B.K. Panigrahi and B. Viswanathan)

36th Annual Meeting of Technical Working Group (TWG) – Fast Reactors (FR)

May 12-16, 2003

The 36th Annual Meeting of TWG-FR on "Status of National Programme on Fast Reactors (FR) and Accelerator Driven Systems (ADS), and Technical Meeting to "Preserve Fast Reactor Physics Knowledge" were held at Korea Atomic Energy Research Institute, Taejon from 12-16 May 2003. The meeting was attended by Members of the Group from the Member States Brazil, France, Germany, India, Japan, Kazakhstan, Republic of Korea, Russia, the United Kingdom and United States of America.

The objective of the two meetings were: (1) to exchange information on the status of operating experience and R&D on FR and ADS; (2) to review the Co-ordinated Research Programme and Technical Meetings in the field of FR and (3) status of fast reactor data retrieval and knowledge preservation.

Phenix operation is cleared for 6 cycles of 120 EFPD, about 5.5 y of irradiation to conduct experiments in the scope of nuclear waste. The reactor will operate on 2/3 power. 47 steam generator reheater and superheater modules in SS 321 grade have been repaired. Two sodium leaks occurred, one in purification circuit of one of the secondary loops and the second from e.m. pump of hydrogen leak detection system during commissioning. Superphenix is under decommissioning. 650 core SA have been unloaded. 58 French nuclear plants operated satisfactorily in 2002, with an availability factor of 82% generating 78% of total electricity.

FBTR operated at power level of 17.4 MWt corresponding to peak linear heat rating of 400 W/ cm. The peak burn up in the fuel is now 101.5 GWd/t without any clad failure. A sodium leak of about 75kg occurred in primary sodium purification circuit due to manufacturing defect in a valve. The detailed design, manufacturing technology, and safety review for 500 MWe PFBR were continued. Excavation clearance has been obtained from AERB in June 2002. MoEF has given clearance in April 2003. Ministry of Finance, Planning Commission and Ministry of Power have cleared the project. Manufacturing technology development of transfer arm was completed and is undergoing tests in air. Manufacture of evaporator tube bundle was completed. Plates of 8 m x 2 m x 30 mm thick were successfully produced indigenously in SS 316LN, Gr 91 and A48P2. Important R&D works included PFBR shielding experiments using APSARA, in-sodium testing of CSRDM, testing of secondary sodium pump model in water, structural mechanics testing of IHX tube to tubesheet joint and 5G expansion bend, and sodium fire suppression performance of leak collection tray.

The experimental fast reactor JOYO has been upgraded to MK-III version with thermal power enhanced to 140 MW in comparison to 100 MW for MK-II version. MK-III initial criticality is scheduled in July 2003. Monju is shutdown since December 1995 subsequent to a sodium leak event in the secondary sodium circuit. A number of plant modifications have been planned as counter measures against sodium leakage. Feasibility studies of 1500 MWe were presented. The preliminary steel material estimates for NSSS of 1500 MWe reactor is 1.75 t/MWe.

BN-350 reactor which was operated successfully for 17y until 1999 is presently under decommissioning. Cesium traps using RVC have been installed in the primary circuit as part of decontamination of primary sodium circuit. KALIMER-600 design was presented. The key design features are 600 MWe/1500 MWt, pool type, metallic fuel, no blanket and 3 secondary loops.

Load factor for BN-600 reactor in 2002 was 77.35%. Two unplanned shut downs occurred in 2002. BOR-60 was operated at 55 MW power. 2 unscheduled shut-downs occurred. BR-10 reactor was shutdown in December 2002 and the stage is set for its decommissioning. BN-800 civil construction and placement of orders for manufacture of components is in progress. BN-800 is likely to go into operation before 2010. 30 nuclear plants were in operation in 2002 in Russia with installed capacity of 22 GWe.

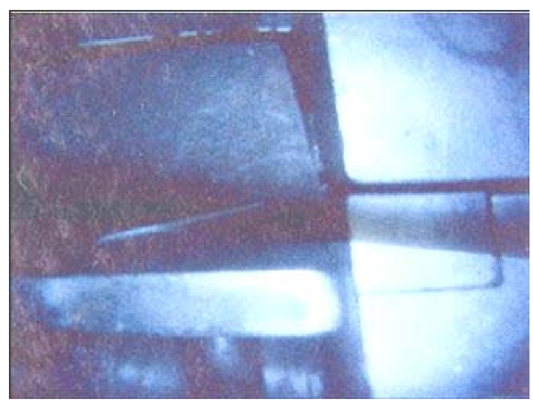
In USA, main activity is directed towards Generation-IV road map. Six Generation-IV systems were presented which included four fast reactor systems with different coolants. For sodium cooled fast reactors, there is no technological issue.

Presentations were made on the knowledge preservation activities in France, Germany, UK, Russia and USA. France has made the most significant progress in knowledge preservation database. Their database will include the knowledge acquired through design and operation of Rapsodie, Phenix, Superphenix, SPX2 and EFR projects. 22 R&D items had been identified. For each item, CEA, EDF and Framatome specialists worked together to prepare a state-of-art synthesis report.

(S.C. Chetal

Commissioning of Lead Mini Cell Facility

Lead Mini Cell Facility (LMC) was given clearance for the first two campaigns of irradiated FBTR fuel pins based on the successful trial operations with natural uranium. The first campaign with low burn up mixed carbide (U, Pu) pins was taken up on 14th June 2003. The fuel pins, loaded in a special magazine, were transferred to the cell through an alpha tight container. The pins were chopped with the single pin chopper developed indigenously. All the systems functioned satisfactorily as per the design and specifications. The cutting blade was energized by an air cylinder. By adjusting the gas pressure to the cutting cylinder the optimum cutting pressure was determined. The corresponding pressure, during trials with unirradiated uranium carbide pins were lower. The behaviour of the spacer wire during cutting trials was observed using a remotely replaceable camera. During cutting, argon purge was given to sweep the aerosols into the dissolver. After cutting all the pins, nitric acid wash was given to remove the powder adhering to the chopper.



Photograph showing the fuel pin being sheared

These chopped pellets will be taken up for electrolytic dissolution, feed clarification, solvent extraction, partitioning and reconversion.

With this, a major activity in closing the FBR fuel cycle has stared.

(R. Natarajan)

Quality Circle Annual Awareness Day –2003

The Quality Circles movement was introduced in the Indira Gandhi Centre for Atomic Research in a big way around three years ago. Since then, the steering committee of Quality Circles, was celebrating the anniversary of the inception in IGCAR.

This year, the Quality Circles Awareness Day -2003 was celebrated on 18th February in the Vikram Sarabhai Auditorium of IGCAR as a one-day programme. The highlights of the programme is briefly listed below:

Shri Y.C. Manjunatha, Chairman, Steering committee of Quality Circles in Engineering Services Group & Associate Director, ES Group welcomed the gathering. This was followed by a thought provoking Presidential address by Shri S.B. Bhoje, Director of Indira Gandhi Centre for Atomic Research. Shri A. Sanjeeva Rao, Chairman, QC Forum of India, Chennai Chapter & Executive Director, Sanjeev Quality Consultants, Chennai was the Guest Lecturer of the day. He has delivered a keynote address on " Sustaining Quality Circles Activities in a Research Organisation".

The afternoon session started with case study presentations from the participating Quality Circles. In all, 12 Quality Circles from Schools, Hospital, Madras Atomic Power Station, General Services Organisation and Indira Gandhi Centre for Atomic Research have presented their case studies in the competition.

Shri S.C. Chetal, Director, REG has concluded the valedictory session with valuable remarks and distributed the certificates to the participants and the trophy to the winning team.

(*K. I. John*, Secretary, Organisation Committee, QC Awareness Day -2003)

Environmental Clearances for PFBR

As per the Environmental Protection Act 1986, construction and operation of any major industry such as the proposed 500 MWe Prototype Fast Breeder Reactor (PFBR) requires statutory clearances from the Ministry of Environment and Forest (MoEF) and from the State Pollution Control Board.

M/s MECON Limited, Ranchi conducted a year long detailed study and prepared a report of the Environmental Impact Assessment / Environmental Management Plan (EIA/EMP), one of the pre-requisites for obtaining the clearances.

It is also mandatory to have a public hearing to seek the public opinions / views / objections on the proposed plant. A public hearing for PFBR was conducted on July 27, 2001 at the Collectorate, Kanchipuram. It is for the first time that a public hearing was held for a nuclear power plant in India. The hearing was well attended by the general public, media representatives of several NGOs and others. There were some objections to the project on socio-economic and non-technical grounds. There were hardly any substantive technical issues raised during the hearing. Detailed replies/responses to all the issues raised were prepared by the department and sent to TNPCB. Clarifications sought were also provided. Based on these, a No Objection Certificate was issued by the State Govt. However, being the first experience of its kind, TNPCB recommended a health survey of nearby villages in order to allay public fears about radioactive effluent discharges.

An application along with copies of EIA/EMP report, the minutes of public hearing and the recommendations of TNPCB was submitted to MoEF for seeking environmental clearance. An Experts Committee constituted by MoEF reviewed the documents. The Committee appreciated the comprehensive manner in which the technical details were given by IGCAR, and in particular the efforts made by the Centre in preparing detailed responses to issues raised during the public hearing as well as to those raised later by the Committee itself. The Committee also visited Kalpakkam in Jan. 2003 for a first hand appraisal of the existing nuclear facilities, before recommending issue of environmental clearance for PFBR. The MoEF conveyed the approval in April 2003.

(A. Natarajan and V.Rajagopal)

Inauguration of New Amenities at Anupuram Township

Shri S.B. Bhoje, Director, IGCAR & and GSO inaugurated Convention Centre and Atomic Energy Central School (AECS) Building located at Anupuram Township on 15.6.2003. This Convention Centre consists of an auditorium, which can accommodate 200 persons, and has all audio-visual facilities for conducting Symposia, presentations and cultural programmes. A meeting room for 20 persons and a briefing room for accommodating 30 persons are also a part of the Convention Centre. In his inaugural speech, Shri Bhoje pointed out that this Centre was conceived as a place where DAE facilities at Kalpakkam could interact with the general public, educational institutions in and around Kalpakkam, academia and industrial / technical and business visitors without need for rigorous security restrictions for the participants from outside DAE. Details of the benefits emanating from various activities of Department of Atomic Energy will be disseminated to the wider public and the academia through programmes held atthis Centre. Figs. 1 & 2 show the inauguration of Convention Centre and AECS building.

(Reported by P.V. Kumar)

Fig.1 Shri S.B Bhoje inaugurating the Convention Centre

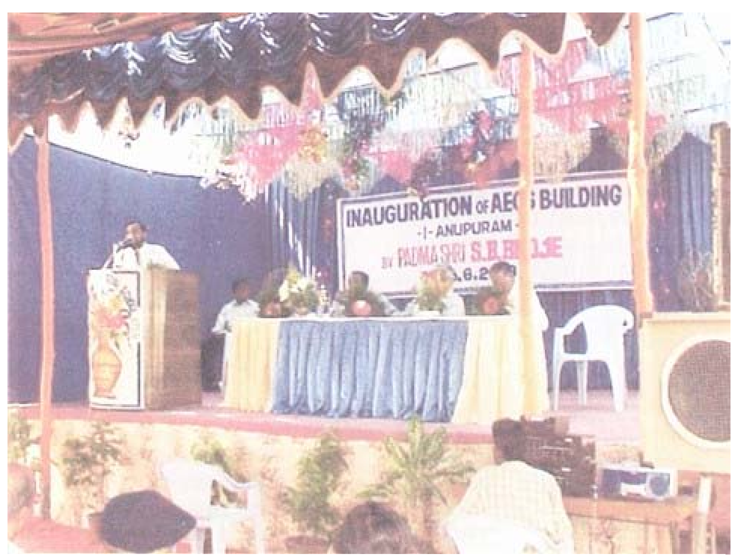


Fig. 2 Inaguration function of AECS Building

FORTHCOMING SYMPOSIA / SEMINARS / CONFERENCES

Workshop on "Utilisation of Energetic Ion Beams for Materials Research"

July 29-31,2003

Collaborative research programmes, in the area of accelerator based materials research is being pursued at IGCAR over the last 10 years. Recently, a 1.7 MV Tandetron accelerator with high beam current and heavy ion capability has been commissioned as a major research facility at Kalpakkam. Experimental setups for ion beam analysis work involving RBS, channeling and nuclear reaction analysis have been installed. A three day Workshop sponsored by IUC-DAEF, is being organized at MSD IGCAR during July 29-31, 2003, with the following objectives: (1) To familiarize potential collaborators from universities with the beam line experimental facilities and the area of materials research being pursued at MSD, IGCAR, (2) To identify research areas of overlapping interest, based on which collaborative research proposals from universities may be invited. The deliberations of the proposed workshop will include talks by experts on different topics of accelerator based material science and intensive discussions involving the speakers and the participants.

Topics to be covered in the workshop include, accelerator details, beam specifications and research capabilities at Kalpakkam, Beam line instrumentation, ion beam analysis techniques -RBS, channeling, NRA, PIXE. Complementary materials characterization tools, ion beam synthesis of nano-clusters, recent trends in ion bombarded semi conductor materials, irradiation effects in metals & alloys including reactor materials, surface modification and ion beam processing.

Dates of the Workshop	:	July 29 -31, 2003 (Three days)
Venue of the Workshop	:	IGCAR, Kalpakkam
Sponsored by	:	IUC-DAEF, Indore
Local Organiser	:	Materials Science Division, IGCAR, Kalpakkam

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4th International Conference on Creep, Fatigue Interaction

(October 8-10, 2003)

The 4th Conference on Creep, Fatigue and Creep-Fatigue Interaction will be held at Indira Gandhi Centre for Atomic Research, Kalpakkam, during October 8-10, 2003. This conference, being held after a gap of four years, aims to provide a forum for interaction and exchange of ideas among scientists, engineers and academicians engaged in high temperature materials research. It is planned to organise several technical sessions in which contributed papers as well as invited talks by leading specialists from India and abroad would be presented. The conference is being organised jointly by The Indian Institute of Metals, Kalpakkam Chapter and Metal Sciences Division, and Indira Gandhi Centre for Atomic Research.

We have received overwhelming response to the conference announcement. Twenty leading specialists from India, China, Japan, Canada, Germany and USA have agreed to present invited talks. More than fifty contributed papers have been accepted for presentation in the Conference. The topics covered include, creep and fatigue deformation and damage mechanisms, creep, fatigue and creep-fatigue crack growth, design methodology and codes for high temperature service, structural integrity analyses and life extension of components, superplasticity and miniature specimen testing.

Important Date

Deadline for submission of manuscript in camera-ready format is extended to June 30, 2003.

For more details, contact

Dr. S.L. Mannan

Convenor

4th Conference on Creep, Fatigue and Creep-Fatigue Interaction

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Seventeenth National Heat and Mass Transfer Conference and Sixth ISHMT / ASME Heat Mass Transfer Conference

January-5-7,2004

The above conference is planned under the auspicious of Indian Society for Heat and Mass Transfer in association with the American Society of Mechanical Engineers. This conference is held once in two years starting from 1971. Abstracts are invited on the subject of Heat & Mass Transfer including theory and applications. For more details visit the web site http:// www.igcar.ernet.in/seminars/nhmtc.htm

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