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INSIDE THE NEWSLETTER

New Year Message

I wish you and your families a very happy and prosperous New Year.

We are entering a new challenging and eventful year 2003, as we are closer to start of construction of PFBR. Before we mention the targets for the next year, it will be worthwhile to take stock of our accomplishments during the year 2002. It has been truly an eventful and successful year in terms of all round performance of the center. We have realized many targets set forth in the IX plan and have also obtained approval for most of the X plan proposals. A few main achievements in the last year are; the realization of 100 GWd/t burnup and LHR of 400 W/cm in Sept. 2002, for mixed carbide fuel in FBTR, is a noteworthy event. This remarkable achievement is a real testimony to collective efforts of designers, fuel fabricators, reactor operators, PIE and other staff. Successful handling of a primary sodium leak in FBTR is also praiseworthy. The start of commissioning of lead mini cell (LMC) is another important landmark in reprocessing of the carbide fuel. It will validate the processes and equipment designs. We have also started on the commissioning of Steam Generator Test Facility (SGTF), 1/4 scale hydraulic model of reactor assembly, seismic shake table. Apart from these, we have also successfully commissioned the liquid helium plant and 1.7 MV Tandem accelerator for basic research studies. The Boron enrichment plant is performing well. We have submitted to the Government of India a Detailed Project Report (DPR) outlining the need, design, R&D, cost, schedule etc for the construction of PFBR and have received necessary clearances from AERB and State Government and approval from Atomic Energy Commission.

Most of the civil works in IGCAR and township have been completed. On the housing front, we have received approval for the construction of 200 houses in various categories, which will improve the level of satisfaction for the eligible category accommodation. We have started the construction of a new school building in Anupuram township.

During the year 2003, the following are the targets towards the construction of PFBR; early completion of balance design works including quality assurance and system engineering, completion of all R & D works for design validation, clearances from MoEF and AERB for first pour of concrete and administrative & financial approval for the project. We all should work towards the national aspiration in a dedicated, coordinated and timely manner. Following quotation is appropriate at this time,

Greatness most often results not from extraordinary ability,

but rather from ordinary ability followed through with extraordinary devotion.

Commitment, depth of passion and clarity of purpose will elevate even the most ordinary efforts into the realm of truly great achievement.

I also wish you a Happy Pongal.

(S.B. Bhoje)
Director

The Saga of FBTR Fuel Achieving 100,000 MWd/t Burnup

Condensed speech of Shri S.B. Bhoje, Director, IGCAR at the function to commemorate the event of FBTR Reaching a Fuel Burnup of 100,000 MWd/t at Sarabhai Auditorium, IGCAR on October 3, 2002

Dr. Anil Kakodkar, Chairman, Atomic Energy Commission and Secretary, DAE, our new additional secretary Dr. D.K. Shankaran, Dr.C. Ganguly, Chairman and Chief Executive, NFC, Shri N. Srinivasan, Shri S.R. Paranjpe, Dr. P. Rodriguez former directors of this centre, Shri G.R. Srinivasan, Vice Chairman, Atomic Energy Regulatory Board, Chairman SARCOP and Chairman PFBR Project Design Safety Committee, other invitees and all my colleagues in IGCAR. Today we have gathered here on the occasion of achieving 100,000 MWd/t burnup, on a totally new fuel, without any fuel failure. It is an important milestone in the development of breeder reactor programme in India.

On this occasion, I would like to recall, in brief, FBTR fuel story from the beginning of the project, so that you can realize the importance of this event. An agreement was signed with CEA, France in 1968 for building FBTR, similar to Rapsodie Fortissimo reactor at Cadarache. The fuel used in the French reactor had a composition of 30% PuO_2 – 70% UO_2, uranium being enriched to 85% in U^{235}. Since India had only plutonium as the fissile material, we made an equivalent physics design of core, having 76% PuO_2 – 24% UO_2, uranium in the natural form. This would have been an indigenous fuel with a slightly higher breeding ratio. Fabrication trials and sodium compatibility experiments were carried out at Fontenay aux Roses laboratory in France, as we did not have Pu laboratory at that time. These studies indicated difficulty in controlling the O/M ratio at desired level compromising to lower thermal conductivity and therefore lower linear heat rating. Second more important result was that the fuel reacts with sodium, resulting in its volume increase by about 40%. A serious question arose as to how to proceed with the project.

Dr. Sarabhai, the then Chairman, AEC, talked to French authorities and it was decided to go for the proven fuel i.e. 30% PuO_2 – 70% UO_2, with enriched uranium to be supplied by France. During the discussion on the contract for supply of HEU, it was felt that the price was high, which delayed the conclusion of the contract. Then came the Peaceful Nuclear Explosion at Pokhran in May 1974. Consequently, apart from high cost, safeguards were insisted. A golden opportunity of getting HEU was lost. In this process the, FBTR construction schedule got extended. Parallely, an alternate fuel, Pu rich mixed carbide was designed, as it was thought to be an advanced fuel, with potential for high breeding ratio. Design was redone and the composition was refixed as 70% PuC – 30% UC and the small carbide core was decided. Core engineering analysis gave a surprise that the fuel linear power was only about 250 W/cm against a requirement of 400 W/cm, due to low thermal conductivity, melting point and gap conductance. Reactor power was decided as 10 MWt. The fuel burn up was calculated conservatively at 25,000 MWd/t.

Two important issues were identified by all, at the beginning of carbide development viz. clad carburization and fuel–clad mechanical interaction due to high fuel swelling rate. Theoretical studies were made on clad carburization. One study

Mixed Carbide fuel crosses 100,000 MWd/t burnup in FBTR

A celebration function was held at Sarabhai Auditorium on October 3, 2002, which was attended by Dr. Anil Kakodkar, Chairman, AEC and Secretary, DAE, Dr. C. Ganguly, Chairman and Chief Executive, NFC, Shri G. R. Srinivasan, Vice Chairman, AERB and former Directors Shri N. Srinivasan, Shri S. R. Paranjpe and Dr. P. Rodriguez and other distinguished invitees. Shri S. B. Bhoje, Director, IGCAR illustrated the saga of mixed carbide fuel crossing the 100 GWd/t burnup in FBTR. Dr. A. Kakodkar in his address emphasized that "quick addition of nuclear power at competitive cost is important in the national context and we all should work towards this challenge".

Shri N. Srinivasan, Shri S. B. Bhoje, Dr.A. Kakodkar, Dr. P. Rodriguez and Shri S.R. Paranjpe on the dais during the commemoration function.

Excellent performance of Fast Breeder Test Reactor during the 10th irradiation campaign (with 35 fuel subassembly core), from Mar to Sept 2002, has enabled achieving the design linear heat rating (LHR) of 400 W/cm for the indigenous Pu-U monocarbide fuel and pushing the fuel burnup beyond 100 GWd/t without any fuel failure. Satisfactory performance of sodium systems, turbine generator (TG) and safe handling of radioactive sodium leak in the primary sodium purification cabin has generated tremendous confidence. Following are the highlights of this campaign (a) Reactor power was raised to 17.4 MWt for the first time corresponding to the design LHR of 400 W/cm (b) Reactor operated for 60 d at the target power (c) TG remained synchronized with the grid at an average power of 2.2 MWe (max 2.8 MWe) to generate 1.2 million units of electricity (d) Indigenous MK I PU-U carbide fuel attained a maximum burnup of 101.5 GWd/t without failure (e) Maximum sodium outlet temperature from the reactor was 445°C and superheated steam of 400°C at 120 Kg/cm^2 was produced and fed to TG for generating power.

Based on the performance, clearance has been obtained from AERB for the 11th irradiation campaign to push the fuel burnup beyond 120 GWd/t and also acquire further experience with the TG operation with grid.

showed no problem, while other study indicated severe carburization. Amidst comments that FBTR would be 'Purnima in Sodium', it was decided to proceed with this fuel.

Just prior to start up of carbide fuel fabrication in BARC, a proposal was made to change the fuel to nitride, as it was looking more attractive. It was decided to stick to the original choice and went ahead with it. Fuel fabrication flow sheet was developed at BARC Trombay and 23 Fuel Sub Assemblies (FSA) were fabricated during 1983 – 84 and the reactor was made critical on 18th October 1985 with 22 FSA.

All the countries, which were developing FBR, were working on carbide fuel also, but on a very small scale. During 1965 – 71, the full core of BR5 (5 MWt) reactor in USSR, was operated with 90% U^{235} enriched uranium monocarbide fuel. Other fast reactors carried out carbide irradiations at the levels of pins and a few FSA. Total pins in the range of 100 were irradiated in many reactors, but only limited PIE and reprocessing was done. All the countries gave up carbide fuel after 1985. The FBTR experience is unique in terms of composition of the fuel and the scale of use. So far over 2,200 pins have been fabricated and irradiated.

The power was raised in steps after detailed analysis and PIE. Today the choice of mixed carbide fuel for FBTR is vindicated. The fuel has achieved 100,000 MWd/t and the design linear heat rating of 400 W/cm has also been reached.

I congratulate all my colleagues in this centre, BARC, NFC and AERB for their valuable contributions in achieving this landmark.

(S.B. Bhoje)

Primary Sodium Leak Event in FBTR

Sodium is highly reactive with air. It can burn in air at temperatures above 115-130°C. When finely divided into particles, for example aerosol deposits or sodium hydrides, sodium can burn in humid air even at room temperature. In FBTR, the temperature of sodium is 180°C during shut down and fuel handling, while it is as high as 510°C during full power operation. To avoid sodium fires due to radioactive sodium leaking from primary sodium circuit, the main pipes and capacities are surrounded by Double Envelope (DE) and the interspace is inerted with nitrogen. Pipelines of the primary sodium purification circuit are housed in a leaktight mild steel tank called 'Purification cabin' which is kept under nitrogen atmosphere acting as second containment. There are no valves in main circuit, but the purification circuit has many valves which are provided with a leak tight stainless steel bellows as the first barrier against leak Thus, the system has safety features to avoid sodium leak and in case of leak to contain leaked sodium. Two types of leak detectors spark plug type for pipe lines with DE and wire type leak detectors for pipe lines without DE provide leak alarm annunciation when shortened by leaking sodium.

In the first week of April 2002, there was sodium leak inside the purification cabin. By the time the leak could be confirmed and sodium flow through the purification circuit pipelines stopped and circuit drained, some quantity of sodium had spilled over the cabin floor, cladding of pipelines and junction boxes of leak detectors and electrical heater cables. Bulk quantity of leaked sodium (see Fig.1) had collected on the floor of the cabin. The leak was later identified to originate from the valve body of the purification circuit bypass valve through one of the three blind locating holes used to position the body for machining operations by the valve manufacturer. Thickness measurement at the location of these three blind locating holes indicated that the residual thickness available for the top hole was only 0.1 mm (see Fig. 2). The leaky valve was replaced and repair work to plug the holes was completed for all other sodium service valves of similar type.

Removal of radioactive sodium in bulk was a new experience for FBTR personnel. Even to have approach to the purification cabin for preliminary inspection/assessment of leak, ten days waiting period was necessary to allow gamma activity due to Na^{24} to decay. It was observed that about 60-70% of purification cabin floor was covered with solidified sodium. The manhole to access the floor was on the top of the cabin through a

Fig. 1 : Floor of the purification cabin covered with leaked sodium.

ladder which posed the following constraints. (i) Working inside a closed containment under inert atmosphere (ii) utilization of the same small manhole for access to inside and outside and also providing illumination and communication (iii) disposal of collected sodium and (iv) difficult rescue operations if required. Hence an extra manhole with closing arrangement was made on the western side of the cabin wall to get easy access for inspection and removal of sodium. Beta gamma dose measured was 30 mSi/h at the newly made bottom manhole and 900 mSi /h on top of the spilled sodium on cabin floor.

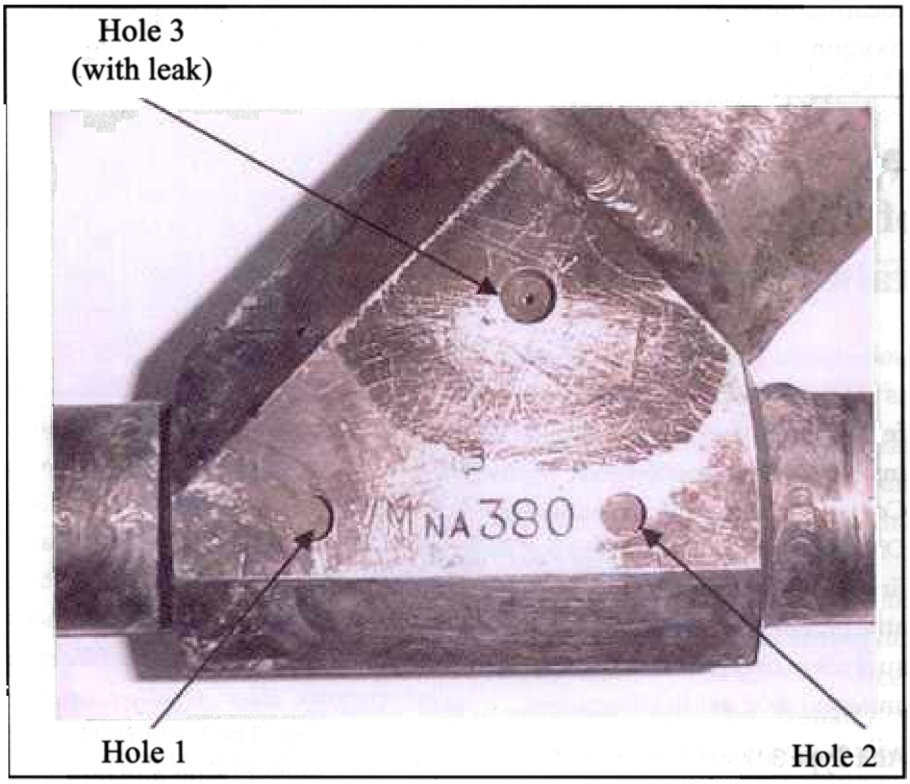

Fig. 2 : Three locating holes on the sodium valve and the leak location.

Based on the experience during mock up trials carried out in Safety Engineering Division for cutting, removal and collection of solid sodium outside the glove box in air, tools for cutting and scooping for use inside the cabin were improvised. 32 kg of sodium was cut and removed through the bottom manhole. This cleared around 50% of the floor area off sodium. Since the thickness of sodium was around 75 mm at the center of the cabin which had a slope towards the centre, further removal of sodium was not possible from the bottom manhole. A cutting tool of longer length was used from the top manhole to chop sodium into smaller pieces. Additional 19 kg of sodium was removed through the bottom manhole after this operation. Gamma ray spectral analysis of the collected sodium revealed ^{203}Hg (4342 Bq/g) and ^{22}Na (2023 Bq/g) as principal radio-nuclides present. Sodium removed from the cabin was sealed inside polythene bags filled with argon, which in turn were stored in drums.

For removing rest of the sodium collected below pipelines and cabin wall, entry inside the cabin was necessary. To avoid working under inert atmosphere the cabin was de-inerted. After ensuring that oxygen level is normal at floor level, when attempt was made to scoop sodium, sparks and minor fires were encountered. The fires were extinguished using dry chemical powder (DCP). The cabin was again inerted with nitrogen and scooping and sodium removal operations were resumed after wearing fresh airline mask with entry through bottom manhole. About 13 kg of sodium collected below pipelines at the floor level and trapped between pipelines and cabin wall was removed and sealed inside polythene bags.

Mineral wool insulation on the pipelines and cladding surrounding it were removed from the pipelines on which leak detectors had actuated. Cladding was also removed from pipelines at the lower level near cabin floor on which spilled sodium accumulation was more. In some places where sodium had come in contact with mineral wool, the insulation had become hard and was removed by chipping. Heaters and leak detectors were removed to facilitate cleaning the outer surface of pipelines, which had come in contact with sodium. In all 75 kg of sodium and its reaction products were removed from the purification cabin in addition to insulation soaked in sodium and cladding.

The following were the difficulties faced and overcome while working inside the cabin;

a) Removal of sodium by working inside the cabin was difficult as most of the cabin floor was covered with leaked sodium. Remote operation from outside the cabin with all precautions ensured removal of sodium with minimum exposure without any contamination. This also reduced radiation field inside the cabin significantly for working inside the cabin. b) Use of DCP while quenching small fires generated lot of dust making visibility poor. Work was temporarily stopped and vacuum cleaner was used to remove DCP from cabin floor and pipelines periodically. c) Dripping of NaOH from clad of pipelines at top level made sodium removal at floor level difficult. Cabin was inerted to reduce oxidation of sodium. d) Because of continuous argon leak from the locating hole of the leaky valve oxygen level inside the cabin remained below the permissible limit even after removing leaked sodium and deinerting the cabin. All works inside the cabin like removal of insulation and replacement of leaky valves were carried out by wearing fresh airline masks.

The leak incident provided the rare experience for O & M personnel in handling bulk sodium and working inside enclosed atmosphere. There was no incident of personnel or area contamination during the entire operation. Total man-rem expenditure was only 130man-mR. The need to minimize quantity of leak was realized and operating procedures for emergency conditions (OPEC) were revised based on the experience. Removal of leaked sodium and purification cabin normalizing works took about three months and the reactor operation was resumed thereafter.

(K.Sasikumar, V.S.Krishnamachari and P.V.Ramalingam)

Microstructure / Surface Characteristics Influence Adhesion of Bacterial Cells on to a Type 304 Stainless Steel

Microbial fouling and microbiologically influenced corrosion (MIC) are processes of considerable technological significance. Adhesion of microbial cells onto wet surfaces and formation of biofilm (microbial fouling) also cause several chemical changes at the metal/biofilm interface leading to MIC. Since adhesion of microbial cells is the first step in MIC, it is very important to examine whether the initial attachment as well as the subsequent growth and proliferation is influenced by metallurgical features of the substratum. The investigations carried out in the Corrosion Science and Technology Division have demonstrated for the first time that there is an increased attachment of bacteria on sensitized surfaces compared to solution-annealed and oxidized surfaces.

AISI Type 304 stainless steel coupons in the solution annealed (1100°C/30min, water quench), sensitized (625°C/24h, air cool) and oxidized (900°C/5 min, air cool) conditions were exposed to a dilute nutrient culture (0.1% nutrient broth) of *Pseudomonas* sp. for various durations of time ranging from 24 h to 168 h. The strain of bacterium used in this study was isolated from a natural biofilm formed on Type 304 SS coupons exposed to fresh water in an open reservoir. The distribution of bacterial cells on various surfaces was studied using epifluorescence microscopy after acridine orange (AO) staining. The bacterial density was determined using a plate count technique.

Figure 1 presents epifluorescence micrographs showing the nature and distribution of bacterial cells on sensitized, oxidized and solution annealed stainless steel surfaces. The bacterial density and the density of aggregation and biofilm coverage were highest in the case of sensitized coupons followed by solution-annealed and oxidized coupons. Most of the cells attached to sensitized and solution–annealed SS specimens were fluorescing orange-red showing the formation of a complex of acridine orange dye with single-stranded ribonucleic acid (RNA), while majority of the cells on oxidized surface fluoresced green showing the formation of acridine orange complex with double-stranded deoxyribonucleic acid (DNA). This observation suggests that the cells on the sensitized and solution-annealed SS are having more RNA and hence are metabolically more active than the cells on the oxidized surface. A difference in the colonization pattern was also apparent with the sensitized and solution-annealed coupons which showed bacterial cells with EPS, embedded in biofilm, whilst oxidized coupons showed scattered attached cells with little evidence of EPS and biofilm. The changes in the bacterial density with time on various surfaces is presented in (see Fig.2).

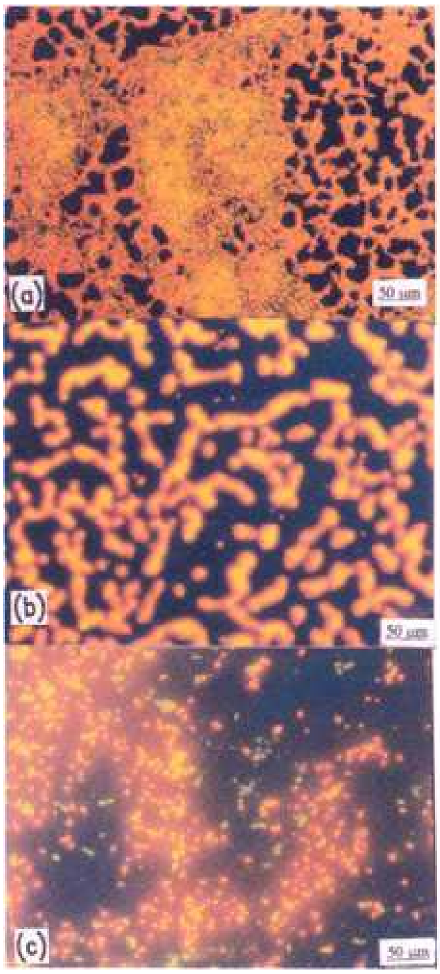

Fig. 1 : Epifluorescence micrographs showing the nature and distribution of bacterial cells on (a) sensitized (b) solution annealed and (c) oxidized stainless steel surfaces.

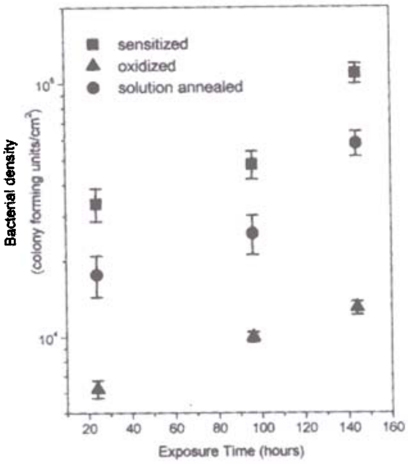

Fig. 2 : The plot of bacterial density on various metallurgical surfaces.

The differences in the colonization behavior of the SS surfaces under different metallurgical conditions suggest that attachment and proliferation of bacterial cells is influenced by the microstructure / chemistry of the surface. Since the highest bacterial density was observed on the sensitized surface, it is possible that the susceptibility of this surface to intergranular corrosion, and thereby release of iron, favoured bacterial attachment. It is well known that release of iron ions from sensitized surfaces will be more than that from a solution annealed or oxidized surface, as the chromium–depleted grain boundary zones have no protective Cr-rich oxide film. Iron plays a fundamental role in microbial growth and metabolism. Microorganisms growing under aerobic conditions need ferric ion for a variety of functions such as an intermediate species for electron transport for the reduction of oxygen during the synthesis of adenosine triphosphate, reduction of ribotide precursors of DNA, for formation of heme and many other essential purposes. The aerobic atmosphere of our planet has caused the surface iron to become converted to oxyhydroxide polymers of very sparing solubility. These environmental restrictions and biological needs have required microorganism to form specific molecules known as siderophores that chelate the ferric ion present in the environment and transport it across the cell membrane. Therefore, detection of siderophores in a culture, is a strong evidence for the iron requirement of these bacteria. The production of iron-binding siderophore by the *Pseudomonas* sp. used in this study was demonstrated by a technique called chrome azurole-S agar assay, thus confirming the iron requirement of the bacterial species.

The present results viz., enhanced MIC on sensitzed surface, are significant in the context of preferential corrosion of weldments during MIC of service components. Since sensitization is one of the metallurgical changes that can take place during the welding of SS it can facilitate colonization of microorganisms on weldments, thus favouring corrosion of the weld.

(Rani P. George, P. Muraleedharan and H.S. Khatak)

Microcontroller based Thermometric Titroprocessor

A microcontroller based, user-friendly thermometric titration system has been developed. A commercially available motor driven titrant dispensing unit was interfaced with the microcontroller. A precision ultrasensitive thermometric method has been designed and developed to measure the temperature change. A typical titration experiment was conducted and satisfactory performance was observed.

The 8031 based microcontroller system comprising digital I/O lines, 16 bit timer, counter, and RS232 serial communication facility was configured to suit the application.

A block diagram of the system is illustrated in the figure 1. The microcontroller enables control functions of the dosimat like feeding, filling and dispensing the titrant through a calibrated burette. The microcontroller also takes care of the cock valve that decides the titrant flow direction. The controller has been programmed to dispense the titrant to the titration cell at a fixed rate of 200 ml/minute. The desired flow rate is realized by fixing the number of strokes per minute. The stroke volume is fixed by the calibrated burette bore size and the piston stroke length. A precision timer decides the stroke length. Thus a precise programmable amount of titrant can be dispensed.

A sensitive thermistor as a member of a wheatstone bridge is used to measure the temperature. As we are interested in measuring a very small change in temperature, a lock-in-amplifier (LIA) is adapted to process the bridge output. The LIA applies a stable AC excitation voltage to the bridge. The final output is extracted by synchronous demodulation. An integrating type ADC has been realized involving the timer, counter of the microcontroller to measure the LIA output signal. The conversion time of the ADC is 100 mS. Resolution is better than 14 bit. The thermometric method is optimised to give 26000 counts for a temperature span of 1°C.

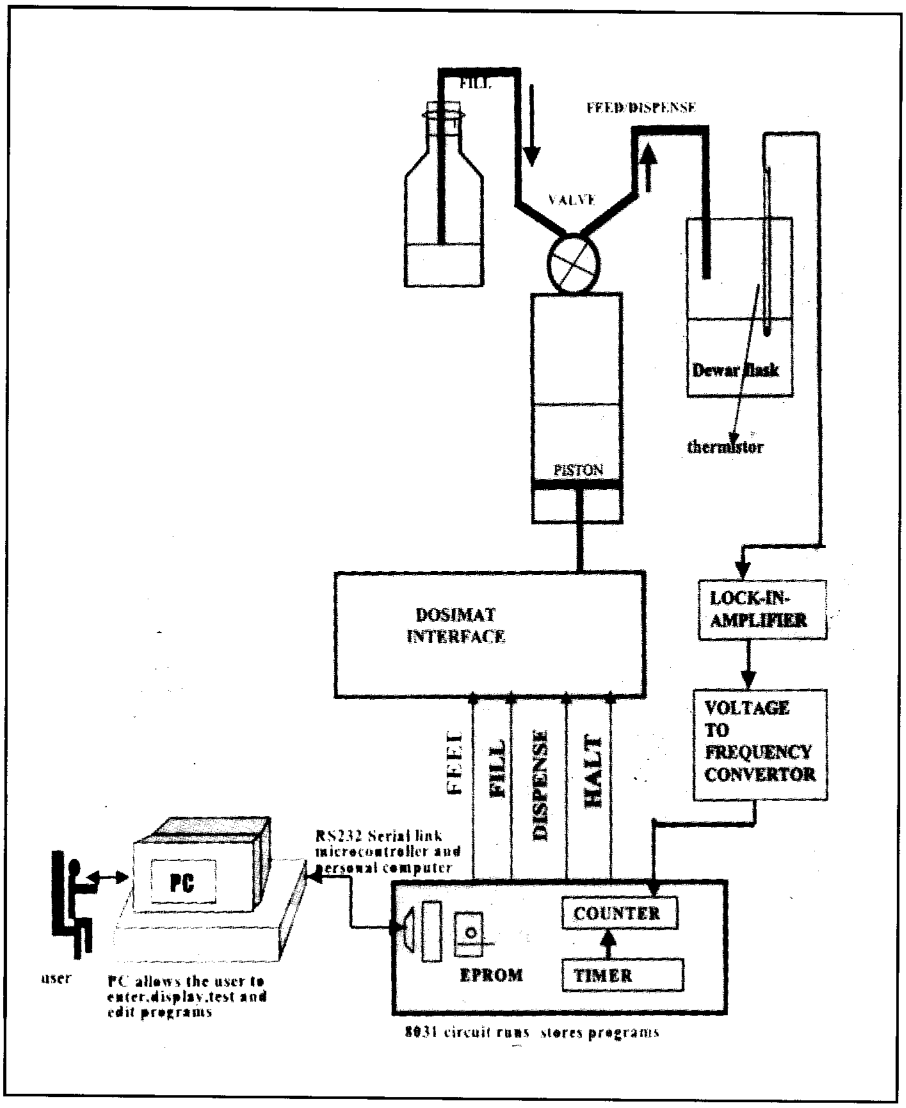

Fig. 1 : Block diagram of microcontroller based titroprocessor.

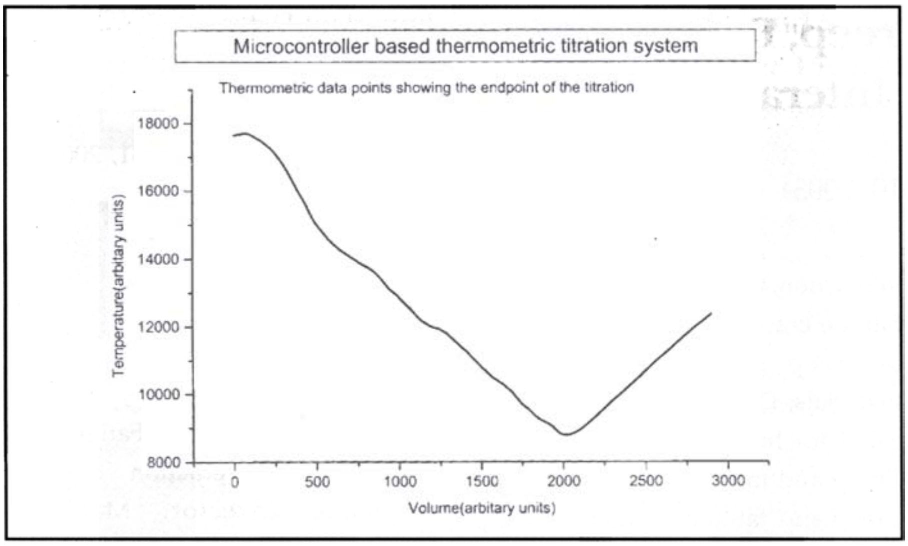

Fig. 2 : Test results of thermometric data obtained using the Tetroprocessor.

Software features: The user interactive routines were developed in Visual Basic. The software communicates with the microcontroller through RS232 for sending various operational commands and for receiving the acquired data. The hardware intensive microcontroller routines are developed in assembler level and stored in EPROM. The software in VB includes the overall supervisory routine, graphical display routine etc. A user-friendly experimental procedure is developed in Visual Basic to dispense the titrant at the rate of 0.7 ml for every thermometric sampling. The thermal data results are graphically displayed and also logged in a file in ASCII format. A typical graph plot realized is shown in figure 2. A few experimental runs have been conducted satisfactorily. More rigorous tests are in progress to evaluate various performance specifications.

(R. Parthasarathy, Jalaja Madan Mohan and K.C. Srinivas)

FORTHCOMING SYMPOSIA/SEMINARS/CONFERENCES

26th IARP Conference National Conference on Radiation Exposure Control at Nuclear Fuel Cycle Facilities and Radiation Installations

March 5-7, 2003

The 26th Annual Conference of the Indian Association for Radiation Protection (IARP) is being organised at Kalpakkam by the IARP (Kalpakkam Chapter) in collaboration with Safety Research Institute, Indira Gandhi Centre for Atomic Research and Nuclear Power Corporation Ltd.

Scientific Programme

The programme of the conference will consist of invited talks, pro-offered papers (oral) and posters. Experts in the relevant fields will discuss current status and the projected strategies and goals of radiation protection. Lectures by eminent persons in the field of Radiation Protection are also planned under plenary sessions. The major scientific thematic areas are listed below:

1. Occupational Radiation Protection
   - Nuclear Fuel Cycle Facilities
   - Accelerator Facilities
   - Medical Diagnosis and Therapy
   - Industrial Applications of Radiation
2. Radiation Protection of the Public
   - Liquid and Gaseous Discharges
   - NORM
   - Emergency Preparedness
3. Dosimetry and Instrumentation
   - Internal and External Exposure
   - Environmental Dosimetry
   - Computational Methods

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4th Conference on Creep, Fatigue and 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. It is planned to organise several technical sessions in which contributed papers as well as invited talks by leading specialists from various countries would be presented. The conference is being conducted jointly by The Indian Institute of Metals, Kalpakkam Chapter and Metal Sciences Division, and Indira Gandhi Centre for Atomic Research.

Topics to be Covered

Creep and fatigue deformation and damage mechanisms; Creep-fatigue interaction, Creep, fatigue and creep-fatigue crack growth; Development of creep and fatigue resistant materials; Design methodology and codes for high temperature service; Creep and fatigue of welded joints; Creep and fatigue of intermetallics, composites and ceramics; Environmental effects; Damage assessment using NDE techniques; Modeling and simulation; Life prediction approaches including expert systems; Remnant life assessment and life extension of components; Failure analysis; Superplasticity; Miniature specimen testing.

Important Dates

Intimation of acceptance of abstracts : Jan. 31, 2003

Submission of manuscript May 31, 2003

For further details, contact

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Seventeenth National Heat and Mass Transfer Conference and Sixth ISHMT/ASNE 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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Dr. Anil Kakodkar, Chairman, AEC and Secretary, DAE visited IGCAR on November 15, 2002

Inauguration of PFBR Administrative Building.

Commissioning of Steam Generator Test Facility.

Commissioning of Shake Table at Mechanics Structural Laboratory

Commissioning of Liquid Helium Plant at Materials Science Division

Dr. S. Narayan, Finance Secretary, MoF, GoI and Shri S. Prabhakaran, Member Finance, AEC visited IGCAR on October 19, 2002 for discussions on the role of Breeder reactors and the status of PFBR.

Dr. S. Narayan, Finance Secretary, Ministry of Finance planting a sapling at PFBR construction site.

Shri S. Prabhakaran, Member Finance, planting a sapling at PFBR construction site.

Awards / Honours

Indian Nuclear Society (INS), Kalpakkam Branch has been awarded the best all-round-performance award and Dr. S. M. Lee, Chairman, INS, Kalpakkam Branch received the trophy.

Dr. Baldev Raj, MCRpG has been elected to Editorial Member of MAPAN – Journal of Metrology Society of India.

Dr. V.S. Raghunathan, Materials Characterisation Group (MCG) has been awarded the G.D. Birla Gold Medal of Indian Institute of Metals.

Dr. T. Jayakumar, DPEND received 'Metallurgist of the year' Award by IIM for the year 2002.

Dr. P. Shankar, MCG has been awarded the ' Young Metallurgist of the Year' award by IIM for the year 2002.

Dr. Arup Dasgupta, MCG received 'Young Engineer Award' –2002 of Indian National Academy of Engineers (INAE).

Shri Y. Ramaseshu, DPEND has been awarded Innovative System Design Award - 2002 by Indian Society for Non-destructive Testing.

Shri Vincent Paul Raj, MCG has been awarded DAE Meritorious Service Award – 2002, instituted by BARC.

Dr. A. Bharathi, Materials Science Division (MSD) has been awarded Materials Research Society of India (MRSI) Medal for the year 2003.

Dr. C.S. Sundar, MSD has been elected as Honorary Faculty Member of Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore.

Shri A. Ravishankar, Reprocessing Group has been awarded INS medal for the year 2001.

Kalpakkam Science & Technology Awards

The award for the best work done in the Category of Basic Sciences in the year 1997-98 went to the team consisting of Dr. K. Sankaran, Shri K. Sundararajan, Dr. V. Vidhya and Dr. K.S. Viswanathan, from the Materials Chemistry Division of Chemical Group.

The award for the best work done in the Category of Applied Sciences in the year 1997-98 was given to Dr. V. Meenakshisundaram, Dr. V.M. Raghunath, Shri R. Mathiyarasu and Shri T.S. Selvakumaran from Health and Safety Division.

The award for the best work done in the Category of Basic Sciences in the year 1998-99 went to the team consisting of Dr. V.S. Srinivasan, Dr. M. Valsan, Smt. R. Sandhya, Dr. K. Bhanu Sankara Rao and Dr. S.L. Mannan, from Materials Development Group.

The award for the best work done in the Category of Applied Sciences in the year 1998-99 went to the team consisting of Shri Anish kumar, Shri M. Thavasimuthu, Dr. T. Jayakumar, Shri P. Kalyanasundaram and Dr. Baldev Raj, from the Division for Post Irradiation Examination and Non-destructive testing.