

# **fusion technology**<sup>TM</sup>

## **CONTENTS / NOVEMBER 1994—VOL. 26, NO. 3 PART 2**

**Proceedings of the  
ELEVENTH TOPICAL MEETING ON THE  
TECHNOLOGY OF FUSION ENERGY  
New Orleans, Louisiana  
June 19–23, 1994**

- xiii Comments / *George Miley*  
xv Preface / *John G. Gilligan, Wayne A. Houlberg*

**INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)**

- 273 Overview of the Design of In-Vessel Components for ITER / *R. R. Parker,  
ITER Joint Central Team*
- 284 The ITER In-Vessel System / *D. C. Lousteau*
- 292 Assembly Plans for ITER / *Frederick A. Puhn, Akira Oikawa*
- 300 A Review of ITER Blanket Designs / *L. Green, M. D. Carelli, F. Stefani,  
G. Dave Morgan, V. Dennis Lee, R. Mattas*
- 316 Evaluation of Pumping and Fueling Requirements for the ITER EDA / *W. A.  
Houlberg, S. E. Attenberger*
- 322 Sensitivity of ITER MHD Global Stability to Edge Pressure Gradients / *J. T.  
Hogan, A. Martynov*
- 327 ITER Design: Physics Basis for Size, Confinement Capability Power Levels  
and Burn Control / *Nermin A. Uckan, J. Hogan, W. Houlberg, J. Galambos,  
L. J. Perkins, S. Haney, D. Post, S. Kaye*
- 331 Toward a Design for the ITER Plasma Shape and Stability Control System /  
*D. A. Humphreys, J. A. Leuer, A. G. Kellman, S. W. Haney, R. H. Bulmer,  
L. D. Pearlstein, A. Portone*

(Continued)

**ON THIS COVER**

The inserts on this cover depict the major themes of the Eleventh Topical Meeting on the Technology of Fusion Energy, the deuterium-tritium experiments in the Tokamak Fusion Test Reactor (TFTR) and the progress from current large-scale experiments toward fusion reactors, such as the ARIES series of tokamak designs, against a background of a typical street scene in the Vieux Carré.

# **CONTENTS / NOVEMBER 1994–VOL. 26, NO. 3, PART 2**

**(Continued)**

## **TOKAMAK PHYSICS EXPERIMENT (TPX)**

- 343** Mission and Physics Design of the Tokamak Physics Experiment / *G. H. Neilson, D. B. Batchelor, P. K. Mioduszewski, D. J. Strickler, R. J. Goldston, S. C. Jardin, J. M. Bialek, C. E. Kessel, S. S. Medley, J. A. Schmidt, R. H. Bulmer, D. N. Hill, W. M. Nevins, K. I. Thomassen, P. T. Bonoli, M. Porkolab, P. A. Politzer, P. H. Edmonds*
- 351** The TPX Configuration / *T. G. Brown*
- 355** The Engineering Design of the Tokamak Physics Experiment / *John A. Schmidt*
- 361** Heating and Current Drive Systems for TPX / *David Swain, Paul Goranson, Al von Halle, Stefano Bernabei, Nevell Greenough*
- 366** Power Supplies and Quench Protection for the Tokamak Physics Experiment / *Charles L. Neumeyer*
- 371** The TPX Vacuum Vessel and In-Vessel Components / *P. Heitzenroeder, J. Bialek, R. Ellis, C. Kessel, S. Liew*
- 376** TPX Remote Maintenance and Shielding / *Mark J. Rennich, Bradley E. Nelson*
- 381** An Overview of the TPX Neutronics and Shielding Aspects / *S. L. Liew, L. P. Ku*

## **MAGNETIC FUSION EXPERIMENTS**

- 389** Deuterium-Tritium Experiments on the Tokamak Fusion Test Reactor / *J. Hosea, TFTR Team*
- 399** JET Divertor Assembly and Early Operation / *JET Team*
- 406** Recent Results and Future Prospects on the JT-60U Tokamak / *H. Yoshida, JT-60 Team*
- 418** Recent DIII-D Results / *Peter I. Petersen for the DIII-D Team*
- 427** Tritium Processing and Management During D-T Experiments on TFTR / *P. H. La Marche, J. L. Anderson, C. A. Gentile, R. J. Hawryluk, J. Hosea, M. Kalish, T. Kozub, H. Murray, A. Nagy, S. Raftopoulos, R. L. Rossnassler, R. A. P. Sissingsh, J. Swanson, F. Tulipano, M. Viola, D. R. Voorhees, R. T. Walters, TFTR Team*

## **FUSION MAGNET SYSTEMS**

- 437** LHD Magnet System Design and Construction / *O. Motojima*
- 445** The Superconducting Coil System of the Advanced Modular Stellarator Wendelstein 7-X / *W. Maurer, Wendelstein 7-X Technical Group*

**(Continued)**

# CONTENTS / NOVEMBER 1994–VOL. 26, NO. 3, PART 2

(Continued)

- 453** Study of the Tokamak-15 Superconducting Toroidal Field Coil (STFC) Heating Under the Quench / *I. O. Anashkin, A. N. Chudnovsky, D. P. Ivanov, S. V. Kabanovsky, P. P. Khvostenko, I. A. Posadsky, A. N. Vertiporokh*
- 458** The Superconducting Magnet System for the Tokamak Physics Experiment / *Dwight D. Lang, R. J. Bulmer, M. R. Chaplin, T. G. O'Connor, D. S. Slack, R. L. Wong, J. P. Zbasnik, J. H. Schultz, N. Diatchenko, D. B. Montgomery, R. D. Pillsbury, Jr., P. W. Wang, L. Myatt, T. G. Brown, J. C. Citrolo*
- 465** Magnet Design for the International Thermonuclear Experimental Reactor / *Richard J. Thome, ITER Joint Central, Home Teams*
- 473** Design of Poloidal Field Systems for TF Coil Shear Minimization / *L. Bromberg, C. G. Bathke, C. Kessel, P. Titus*

## FUSION MATERIALS AND PLASMA-FACING COMPONENTS

- 481** A Study of SiC/SiC Fiber Composite Stability in Thermochemical Conditions Relevant to Fusion Technology / *A. Donato, L. F. Moreschi, M. L. Apicella, A. Mignone, S. Casadio, C. A. Nannetti, E. Scafé*
- 486** Loads for Pulsed Power Cylindrical Implosion Experiments / *W. Anderson, E. Armijo, B. Barthell, J. Bartos, H. Bush, L. Foreman, F. Garcia, P. Gobby, V. Gomez, V. Gurule, D. Hatch, B. Henneke, R. Manzanares, J. Moore, G. Reeves, G. Rivera, M. Salazar, L. Salzer*
- 493** Innovative Design and Material Solutions of Thermal Contact Layers for High Heat Flux Applications in Fusion Devices / *G. Federici, R. Matera, S. Chiocchio, J. Dietz, G. Janeschitz, D. Driemeyer, J. Haines, M. Tillack, M. Ullrickson*
- 498** Modification and Final Alignment of the TFTR Bumper Limiter / *M. D. McSmith, G. D. Loesser, D. K. Owens*
- 503** Development of Plasma Facing Components with Functionally Gradient Layers / *M. Morimoto, F. Kudough, M. Onozuka, H. Tsunoda, M. Toyoda*
- 507** Tritium Release from JT-60U Vacuum Vessel Following High-Power Heated Deuterium Operations / *N. Miya, M. Nemoto, N. Toyoshima*
- 512** Probabilistic Analysis of Divertor Plate Lifetime in Tokamak Reactors / *Ruxandra P. Golinescu, Mujid S. Kazimi*
- 517** Erosion of Plasma-Facing Components Under Simulated Disruption-Like Conditions Using an Electrothermal Plasma Gun / *M. A. Bourham, J. G. Gilligan*
- 522** Radiation Transport Effects in Divertor Plasmas Generated During a Tokamak Reactor Disruption / *Robert R. Peterson, Joseph J. MacFarlane, Ping Wang*
- 527** Upgrade of the Vapor Shield Modeling Code MAGFIRE / *Eric Tucker, John Gilligan*
- 532** Plasma Disruption Modeling and Simulation / *A. Hassanein*

(Continued)

# CONTENTS / NOVEMBER 1994–VOL. 26, NO. 3, PART 2

(Continued)

- 540** Evaluation of Erosion and Lifetime of ITER Divertor Candidate Materials and Relevant Data from Recent Experiments in the PISCES-B MOD Facility / *Y. Hirooka, J. Won, S. Keller, R. Boivin, M. Khandagle, J. N. Brooks*
- 546** Results from Computational and Experimental Modeling of Runaway Electron Damage on Plasma Facing Components / *K. A. Niemer, J. G. Gilligan, C. D. Croessmann*
- 551** A Design Probabilistic Approach to Define Fusion Materials Data Base Requirements / *R. E. Kothmann, L. Green, M. D. Carelli, M. J. Manjoine, R. E. Wootton*

## PLASMA HEATING AND CURRENT DRIVE, PLASMA ENGINEERING

- 561** Fast Frequency-Step-Tunable Gyrotrons for Plasma Heating and Fusion Diagnostics / *O. Dumbrajs, J. Heikkinen*
- 566** Evaluation of Current Drive Requirements and Operating Characteristics of a High Bootstrap Fraction Advanced Tokamak Reactor / *W. A. Houlberg, S. E. Attenberger*
- 572** Analog Feedback Control of RFP Plasma: Implementation and First Results in the RFX Experiment / *Pietro Fiorentin, Elena Gaio, Giuseppe Marchiori, Roberto Piovani, Vanni Toigo*
- 577** Comparison and Experimental Validation of Different Methods for Eddy Current Calculation in the RFX Conducting Shell / *Pietro Fiorentin, Giuseppe Marchiori, Giuseppe Zollino*
- 582** Startup and Shutdown of the PULSAR Tokamak Reactor / *K. A. Werley, C. G. Bathke*
- 588** TF-Ripple Loss Reduced Alpha Heating / *Thomas Hladschik, Klaus Schoepf*

## DIVERTOR EXPERIMENTS AND TECHNOLOGY

- 595** Helium Transport and Exhaust Studies in DIII-D / *M. R. Wade, J. T. Hogan, D. L. Hillis, R. Maingi, M. M. Menon, K. H. Burrell, R. J. Groebner, M. A. Mahdavi, W. P. West, D. F. Finkenthal, DIII-D Team*
- 603** ITER Divertor Research and Development Activities / *D. Driemeyer, D. Bowers, J. Davis, D. Kubik, H. Mantz, M. McSmith, T. Rigney, C. Baxi, L. Sevier, M. Carelli, L. Green, D. Ruzic, D. Hayden, M. Gabler, J. Yuen*
- 611** A Simpler, Safer, Higher Performance Cooling System Arrangement for Water Cooled Divertors / *M. D. Carelli, R. E. Kothmann, L. Green, N. J. Zhan, F. Stefani, R. M. Roidt*
- 618** Diagnostics Modules for Tokamak Disruption Experiments / *M. L. Nahm, C. D. Buchanan, M. A. Bourham, J. G. Gilligan*
- 623** Design of the PISCES-Upgrade Facility / *Lester M. Waganer, Russell Doerner*

(Continued)

# CONTENTS / NOVEMBER 1994–VOL. 26, NO. 3, PART 2

(Continued)

- 628** Concept Development and Performance Assessment of the Power Exhaust Structure of the ITER Divertor / *S. Chiocchio, G. Federici, G. Janeschitz, R. Tivey, C. Baxi, J. R. Haines, M. A. Ulrickson*

## PLASMA FUELING AND FUEL CYCLES

- 637** Electrothermal Plasma Gun as a Pellet Injector / *R. W. Kincaid, M. A. Bourham*
- 642** Development of an ITER Pellet Fueling System in Russia / *Boris V. Kuteev, Igor V. Viniar, Vladimir Yu. Sergeev, Lev D. Tsendin, Vladimir G. Kapralov, Pavel Yu. Koblenz, Andrey A. Lovtsius, Michael A. Parshin, Pavel V. Reznichenko, Sergei V. Skoblikov, Alexander P. Umov, Victor N. Skripunov*
- 649** Electromagnetic Launch of mm-Size Pellets to Great Velocities / *E. M. Drobyshevski, B. G. Zhukov, R. O. Kurakin, V. A. Sakharov, A. M. Studenkov*
- 654** Measurement of Capacity Coefficient of Inclined Liquid Phase Catalytic Exchange Column for Tritiated Water Processing / *Hideki Yamai, Satoshi Konishi, Toshihiko Yamanishi, Kenji Okuno*
- 659** Use of Magnesium for Recovering Hydrogen Isotopes from Tritiated Water / *R. Scott Willms, Satoshi Konishi, Kenji Okuno*
- 664** Recovery of Tritium by Cryogenic Molecular Sieve Bed in Breeding Blanket Interface Condition / *Mikio Enoeda, Yoshinori Kawamura, Kenji Okuno, Masabumi Nishikawa, Ken-ichi Tanaka*
- 668** Improvements in ZrCo Based Tritium Storage Media / *Satoshi Konishi, T. Nagasaki, T. Hayashi, K. Okuno*
- 673** Evidence of Tritiated Organic Evolution from Stainless Steel Surfaces / *A. B. Antoniazzi, W. T. Shmayda*

## INERTIAL CONFINEMENT EXPERIMENTS

- 681** Implosion Experiment by GEKKO XII and Scaling to Ignition and Burn / *Sadao Nakai*
- 687** Review of Drive Symmetry Measurement and Control Experiments on the Nova Laser System / *J. M. Mack, A. A. Hauer, N. D. Delamater, W. W. Hsing, R. G. Watt, D. A. Baker, D. B. Harris, G. R. Magelssen, J. M. Wallace, L. Suter, D. Ress, L. Powers, O. Landen, R. Thiessen, D. Phillion, P. Amendt*
- 696** Hohlraum Manufacture for Inertial Confinement Fusion / *Larry R. Foreman, Peter Gobby, Jacob Bartos, P. Michael Brooks, Harry Bush, Veronica Gomez, Norman Elliott, Joyce Moore, Gerald Rivera, Mike Salazar, Lee Salzer*
- 702** Performance of the NIF Prototype Beamlet / *Bruno M. Van Wonterghem, John R. Murray, D. Ralph Speck, John H. Campbell*

(Continued)

# **CONTENTS / NOVEMBER 1994–VOL. 26, NO. 3, PART 2**

(Continued)

## **FUTURE INERTIAL CONFINEMENT FUSION FACILITIES**

- 711** Directions for the U.S. ICF Program / *Marshall M. Sluyter*
- 717** Overview of the Nike KrF Laser Program / *John D. Sethian, Stephen E. Bodner, Kent A. Gerber, Robert H. Lehmberg, Edgar A. McLean, Stephen P. Obenschain, Carl J. Pawley, Mark S. Pronko, John A. Stamper, Alban V. Deniz, John Hardgrove, Thomas H. Lehecka, Malcolm W. McGroch*
- 722** The Upgrade to the OMEGA Laser System / *T. R. Boehly, R. S. Craxton, T. H. Hinterman, P. A. Jaanimagi, J. H. Kelly, T. J. Kessler, R. L. Kremens, S. A. Kumpan, S. A. Letzring, R. L. McCrory, S. F. B. Morse, W. Seka, S. Skupsky, J. M. Soures, C. P. Verdon*
- 730** ILSE Heavy Ion Accelerator / *Edward P. Lee*
- 738** Glass Laser System, Gekko XII Upgrade for ICF Ignition / *M. Nakatuska, H. Azechi, T. Jitsuno, T. Kanabe, S. Matsuoka, M. Miyanaga, M. Tada, S. Nakai*
- 745** Laboratory Microfusion Capability Phase II Study / *Gary L. McAllister*

## **NATIONAL IGNITION FACILITY**

- 755** The National Ignition Facility Project / *J. A. Paisner, E. M. Campbell, W. J. Hogan*
- 767** Laser Design Basis for the National Ignition Facility / *J. T. Hunt, K. R. Manes, J. R. Murray, P. A. Renard, R. Sawicki, J. B. Trenholme, W. Williams*
- 772** Target Area Design Basis and System Performance for the National Ignition Facility / *M. Tobin, V. Karpenko, K. Hagans, A. Anderson, J. Latkowski, R. Warren, R. Wavrik, R. Garcia, J. Boyes*
- 780** X-Ray and Debris Ion Spectra Emanating from NIF Targets / *Robert R. Peterson, Gregory A. Moses, Joseph J. MacFarlane, Ping Wang*
- 785** Target Area Chamber System Design for the National Ignition Facility / *Richard Wavrik, John Boyes, Craig Olson, Frank Dempsey, Rojelio Garcia, Victor Karpenko, Andrew Anderson, Michael Tobin, Jeffery Latkowski*
- 791** Plasma Electrode Pockels Cells for the Beamlet and NIF Lasers / *Mark A. Rhodes, B. Woods, J. DeYoreo, J. Atherton*
- 799** Power Conditioning for the National Ignition Facility / *Douglas W. Larson, Robert Anderson, John Boyes*
- 804** X-Ray Response of National Ignition Facility First Surface Materials / *Andrew T. Anderson, Michael T. Tobin, Per F. Peterson*
- 809** Response of the National Ignition Facility Target Chamber Walls to the Microexplosion of a Fusion Target / *Robert R. Peterson, Joseph J. MacFarlane, Ping Wang*
- 814** TSUNAMI Analysis of National Ignition Facility 2-D Gas Dynamics Phenomenon / *Xiang M. Chen, Per F. Peterson, Michael T. Tobin*

(Continued)

# **CONTENTS / NOVEMBER 1994–VOL. 26, NO. 3, PART 2**

**(Continued)**

- 819** Los Alamos Contribution to Target Diagnostics on the National Ignition Facility / *J. M. Mack, D. A. Baker, S. E. Caldwell, R. E. Chrien, B. H. Failor, S. R. Goldman, A. A. Hauer, R. G. Hockaday, J. A. Oertel, W. K. Thorn, R. G. Watt, C. S. Young*
- 829** Target Area Acquisition and Control System Survivability for the National Ignition Facility / *Karla Hagans, Pete Stathis, Jay Wiedwald, Don Campbell*
- 833** Target Alignment in the National Ignition Facility / *Charles S. Vann, Erlan S. Bliss, James E. Murray*
- 837** Target Area Structural Support Systems Design to Achieve the Micron-Level Stability Requirement of the National Ignition Facility (NIF) / *D. S. Ng, V. P. Karpenko, R. Wavrik*
- 842** Neutronics and Shielding Analysis of the National Ignition Facility / *Jeffery F. Latkowski, Michael T. Tobin, M. S. Singh*

## **INERTIAL CONFINEMENT FUSION REACTORS, REACTOR TARGETS, AND DRIVERS**

- 849** Evolution of Light Ion Driven Fusion Power Plants Leading to the LIBRA-SP Design / *G. L. Kulcinski, R. R. Peterson, G. A. Moses, D. Bruggink, P. Cousseau, R. L. Engelstad, Y.-M. Lee, H. Y. Khater, E. G. Lovell, J. J. MacFarlane, E. A. Mogahed, S. Rutledge, M. E. Sawan, I. N. Sviatoslavsky, P. Wang, L. J. Wittenberg*
- 857** Use of the National Ignition Facility for the Development of Inertial Fusion Energy / *M. Tobin, G. Logan, A. Anderson, T. Diaz De La Rubia*
- 868** A Near Symmetrically Illuminated Direct Drive Laser Fusion Power Reactor—SIRIUS-P / *I. N. Sviatoslavsky, G. L. Kulcinski, G. A. Moses, D. Bruggink, R. L. Engelstad, H. Y. Khater, E. M. Larsen, E. G. Lovell, J. J. MacFarlane, E. A. Mogahed, R. R. Peterson, M. E. Sawan, P. Wang, L. J. Wittenberg*
- 873** Automated Target Production for Inertial Fusion Energy / *Michael J. Monsler, Wayne R. Meier*
- 881** Parametric Target Chamber Simulations for the Inertial Fusion Energy Integrated Test Facility / *Robert R. Peterson*
- 886** Radiation Transport Effects in the Target Chamber Gas of the Laser Fusion Power Reactor SIRIUS-P / *J. J. MacFarlane, R. R. Peterson, P. Wang, G. A. Moses*
- 891** Three-Dimensional Thermal and Structural Analysis of the First Wall in the SIRIUS-P Reactor / *Elsayed A. Mogahed*
- 896** Target Injection Methods for Inertial Fusion Energy / *Ronald W. Petzoldt, Ralph W. Moir*
- 906** Coupling of Radiation Transport with the Gas Dynamics for HYLIFE-II Analysis / *Xiang M. Chen, Virgil E. Schrock, Per F. Peterson*
- 912** Fitted Equations of State for Flibe Gas / *Xiang M. Chen, Virgil E. Schrock, Per F. Peterson*

**(Continued)**

# **CONTENTS / NOVEMBER 1994—VOL. 26, NO. 3, PART 2**

**(Continued)**

- 917** Scale Modeling of Oscillating Sheet Jets for the HYLIFE-II Inertial Confinement Fusion Reactor / *Christopher J. Cavanaugh, Per F. Peterson*
- 922** The Light Ion Beam Approach to ICF Energy Production / *R. E. Olson, M. G. Mazarakis, C. L. Olson*

## **FUSION DIAGNOSTICS AND NEUTRONICS EXPERIMENTS AND ANALYSIS**

- 929** A Portable Cylindrical Electrostatic Fusion Device for Neutronic Tomography / *Yibin B. Gu, Jalal B. Javedani, George H. Miley*
- 933** Radiation Shielding for TFTR DT Diagnostics / *L. P. Ku, D. W. Johnson, S. L. Liew*
- 938** Impurity Pellet Injection Systems for Tokamak Diagnostics and Burn Control / *Boris V. Kuteev, Vladimir Yu. Sergeev, Sergey M. Egorov, Vladimir G. Kapralov, Konstantin V. Khlopov, Igor V. Miroshnikov, Dmitriy V. Polyakov, Pavel V. Reznichenko, Peter T. Lang, Klaus P. Büchl, Paul Cierpka, Rudolf S. Lang, Shigeru Sudo*
- 945** Conceptual Design for a Fast Neutron Ionization Chamber for Fusion Reactor Plasma Diagnostics / *W. C. Sailor, Cris W. Barnes, G. A. Wurden, R. E. Chrien*
- 949** FMIF Conceptual Design Activities / *Lawrence Green, Joe Lance, John Rathke, Michael Reusch, Alan Todd, David Bruhwiler, Ed Piechowiak, Jerry Bazinet, Scott Thomson*
- 958** Coupled Diffusion-Transport Calculations of Fusion Reactor Activations / *C. E. Annese, E. Greenspan*
- 963** TFTR Radiation Contour and Shielding Efficiency Measurements During D-D Operations / *H. W. Kugel, G. Ascione, S. Elwood, J. Gilbert, D. Hwang, M. Lewis, J. Levine, L.-P. Ku, K. Rule, F. Hajnal, N. Azziz, P. Goldhagen, G. Klemic, P. Shebell*

## **TRITIUM TECHNOLOGY, SAFETY, ENVIRONMENT, AND REMOTE MAINTENANCE**

- 973** Post Accident Afterheat Generation & Dissipation in Fusion Reactors / *F. Andritsos, M. Zucchetti*
- 978** Corrosion Radioactive Products in a Primary Cooling System of the ITER Plant: A Preliminary ORE Evaluation / *Sandro Sandri, Dan Gabriel Cepraga, Sergio Ciattaglia, Luigi Di Pace, Gilio Cambi*
- 983** Interactions Between an Organic Coolant and Drops of Molten Lithium / *Lloyd S. Nelson, Joseph D. Krueger, Michael L. Corradini*
- 988** Scaling Equations to Model Variations in Operating Conditions for Activation Calculations / *S. K. Ho*

**(Continued)**

# **CONTENTS / NOVEMBER 1994—VOL. 26, NO. 3, PART 2**

**(Continued)**

- 993** Oxide Aerosols Produced from a Tungsten Alloy for Fusion Reactors / *D. L. Hagrman, G. R. Smolik, D. A. Petti, K. A. McCarthy*
- 998** Design, Operation, and Application of the LLNL Portable Tritium Processing System / *T. C. Reitz, P. A. Smuda, M. A. Benapfl*
- 1003** National Ignition Facility Environmental Protection Systems / *J. Mark Mintz, Thomas C. Reitz, Michael T. Tobin*
- 1009** A Radiological Safety Optimization Study for Compact Fusion Machines / *Pietro Corsaro, Giovanni Del Tin, Massimo Zucchetti*
- 1014** Vanadium Recycling / *T. J. Dolan, G. J. Butterworth*
- 1021** Vacuum Component Reliability Estimates for Experimental Fusion Facilities / *L. C. Cadwallader*
- 1025** LOCA Temperature/Hydrogen Generation Parametric Study for ITER TAC4 Design / *M. J. Gaeta, B. J. Merrill, D. A. Petti*
- 1030** Technology Issues for Decommissioning the Tokamak Fusion Test Reactor / *P. T. Spampinato, J. C. Commander, G. R. Walton*
- 1034** Progress in the Development of Methodology for Fusion Safety Systems Studies / *S. K. Ho, G. Cambi, S. Ciattaglia, Y. Fujii-e, Y. Seki*
- 1043** Tritium Technology and Safety at JET / *A. C. Bell, JET Team*
- 1051** Fusion Safety Regulations in the U.S.: Progress and Trends / *John DeLooper*

## **FUSION BLANKET, SHIELD, AND NEUTRONICS TECHNOLOGY**

- 1061** Recent Designs for Advanced Fusion Reactor Blankets / *Dai-Kai Sze*
- 1069** European Blanket Development for a DEMO Reactor / *S. Malang, M. Dalle Donne, L. Anzidei, L. Giancarli, E. Proust*
- 1079** European Reference Design of the Water-Cooled Lithium-Lead Blanket for a Demonstration Reactor / *L. Giancarli, L. Baraer, B. Bielak, M. Eid, M. Fütterer, E. Proust, X. Raepsaet, J. F. Salavy, L. Sedano, Y. Severi, J. Quintric-Bossy, C. Nardi, L. Petrizzi*
- 1086** Tritium Production-Rate Measurement Techniques Developed at FNS/JAERI / *Hiroshi Maekawa, Fujio Maekawa, Yukio Oyama, Chikara Konno, Yujio Ikeda, Kouichi Tsuda, Seiya Yamaguchi*
- 1092** GERAPH: A Novel Approach to the General Solution of Pulsed History Activation Problems / *P. P. H. Wilson, J. E. Sisolak, D. L. Henderson*
- 1098** Spectrum Weighting Function Method for In-Situ Fast Neutron and Gamma-Ray Response Measurements in Fusion Integral Experiments with an NE213 Scintillation Detector / *Yukio Oyama, Kazunori Sekiyama, Hiroshi Maekawa*

**(Continued)**

# **CONTENTS / NOVEMBER 1994—VOL. 26, NO. 3, PART 2**

**(Continued)**

## **FUSION POWER REACTORS, ECONOMICS, AND ALTERNATE CONCEPTS**

- 1105 Advanced Fission and Fossil Plant Economics—Implications for Fusion / Jerry G. Delene**
- 1111 Lessons Learned from the Tokamak Advanced Reactor Innovation and Evaluation Study (ARIES) / R. A. Krakowski, C. G. Bathke, R. L. Miller, K. A. Werley**
- 1119 DEMO & Commercial Fusion Reactors Extrapolated from the ITER and Advanced Physics & Materials Data Bases / Weston M. Stacey**
- 1122 Prospects for Toroidal Fusion Reactors / John Sheffield, John D. Galambos**
- 1127 Advanced Stellarator Power Plants / Ronald L. Miller**
- 1133 Tokamak Power Plant Burn Cycle Options / David A. Ehst**
- 1141 Assessment of First Wall Lifetime in D-<sup>3</sup>He and D-T Reactors with Impact on Reactor Availability / M. E. Sawan, I. N. Sviatoslavsky**
- 1146 CFFTTP Fusion Pilot Plant Scoping Study / P. Gierszewski, G. Williams, J. Blevins, H. Brunnader, P. Cumyn, B. Dean, J. Galambos, C. Holloway, R. Kelly, A. Natalizio, S. Smith**
- 1151 Robust Burn Control of Fusion Reactors with Modulation of Refueling Rate / W. Hui, B. Bamieh, G. H. Miley**
- 1158 Improvement in Fusion Reactor Performance Due to Ion Channeling / G. A. Emmert, L. A. El-Guebaly, G. L. Kulcinski, J. F. Santarius, I. N. Sviatoslavsky, D. M. Meade**
- 1163 A Comparison of Steady-State ARIES and Pulsed PULSAR Tokamak Power Plants / C. G. Bathke, ARIES Research Team**
- 1169 Improvements to the HYLIFE-II Inertial Fusion Power Plant Design / Ralph W. Moir**
- 1178 HYLIFE-II Reactor Chamber Design Refinements / Palmer A. House**
- 1196 Minimum Size  $Q = 1$  and Ignited Spherical Tokamak Devices / John Galambos, Y.-K. M. Peng, John Haines**
- 1203 The Flow-Through Z-Pinch for Fusion Energy Production / Charles W. Hartman, James L. Eddleman, Ralph Moir, U. Shumlak**
- 1207 Tokamak Transmutation of (Nuclear) Waste (TTW): Parametric Studies / R. A. Krakowski, E. T. Cheng, Y.-K. M. Peng**
- 1216 Design, Construction and Commissioning of SGPR, The Fast Protection System of RFX / Pierpaolo Collarin, Francesco Trevisan, Massimo Guarnieri**
- 1221 Initial Results on High Enthalpy Plasma Generation in a Magnetized Coaxial Source / R. M. Mayo, M. A. Bourham, R. W. Caress, D. C. Black, M. E. Glover**

**(Continued)**

**CONTENTS / NOVEMBER 1994—VOL. 26, NO. 3,  
PART 2**

**(Continued)**

**DEPARTMENTS**

**1226 Author Index**

**1230 Subject Index**