

# **fusion technology**

**CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3  
PART 2 (279–1194)**

**Proceedings of the  
THIRTEENTH TOPICAL MEETING ON THE  
TECHNOLOGY OF FUSION ENERGY  
Nashville, Tennessee  
June 7–11, 1998**

- xiii Comments / *George Miley*
- xv Preface / *Thomas E. Shannon, John R. Haines, Mohamed Bourham, John W. Davis*

**ANS ANNUAL MEETING PLENARY SESSION**

- 281 World Population and Energy Demand Growth: The Potential Role of Nuclear Energy in an Efficient World / *John Sheffield*

**FUSION TOPICAL OPENING SESSION**

- 291 Progress of ITER / *R. Aymar*
- 301 Recent Progress in JT-60U Experiments with W-Shaped Divertor / *Tomonori Takizuka, JT-60 Team*
- 308 Results of Recent Deuterium/Tritium Experiments in JET / *A. S. Kaye, JET Team*

**INERTIAL FUSION ENERGY**

- 319 Prospects for Inertial Fusion Energy with a KrF Laser / *J. C. Kellogg, S. E. Bodner, S. P. Obenschain, J. D. Sethian*
- 326 Systems Modeling and Analysis of Heavy Ion Drivers for Inertial Fusion Energy / *Wayne R. Meier*
- 331 Three-Dimensional Neutronics Analysis for the LIBRA-SP Light Ion Fusion Power Reactor / *M. E. Sawan*
- 336 Recent Progress of Fast Ignition Research at Institute of Laser Engineering, Osaka University / *Kazuo A. Tanaka, K. Mima, T. Yamanaka, R. Kodama, Y. Kitagawa, N. Izumi*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

### ADVANCED MATERIALS AND TECHNOLOGY

- 345** U.S. Assessment of Advanced Limiter-Divertor Plasma-Facing Systems (ALPS)—Design, Analysis, and R&D Needs / *R. F. Mattas, R. Bastasz, J. N. Brooks, A. Hassanein, S. Luckhardt, K. McCarthy, P. Mioduszewski, E. Mogahed, R. Moir, N. Morely, R. Nygren, C. Reed, D. Ruzic, I. Sviatoslavsky, D. Sze, M. Tillack, P. M. Wade, K. Wilson, R. Wooley, C. Wong*

### FUSION ECONOMICS AND REACTOR STUDIES

- 353** Effect of Activation Cross Section Change on the Shallow Land Burial Fraction of Low Activation Materials for Fusion Reactors / *Yasushi Seki, Isao Aoki, Shuzo Ueda, Satoshi Nishio, Ryoichi Kurihara, Takashi Tabara*
- 358** Energy Payback Ratios and CO<sub>2</sub> Emissions Associated with the UWMAK-1 and ARIES-RS DT-Fusion Power Plants / *Scott W. White, Gerald L. Kulcinski*
- 364** Overview of the Spherical Tokamak Power Plant Study: Aries-ST / *Ronald L. Miller, ARIES Team*

### INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)

- 371** Physics Design Guidelines and Methodologies Derived from ITER Physics Basis / *N. A. Uckan, D. E. Post, J. C. Wesley, ITER JCT, ITER Home Teams, ITER Physics Expert Groups*
- 377** Transport Performance Simulations of Radiative Power Exhaust Solutions and a Reduced-Cost Option for ITER / *John Mandrekas, Weston M. Stacey, Frederick A. Kelly*
- 384** Design of the ITER Shielding Blanket / *D. Lousteau, K. Ioki, L. Bruno, A. Cardella, F. Elio, M. Hechler, T. Kodama, A. Lodato, D. Loesser, N. Miki, K. Mohri, R. Raffray, M. Yamada*
- 390** ITER Safety: Lessons Learned for the Future / *David A. Petti, Kathryn A. McCarthy*
- 397** Three-Dimensional Neutronics Analysis for the ITER Divertor Cassette Design Options / *M. E. Sawan, R. T. Santoro*

### PLASMA FUELING, HEATING, AND CURRENT DRIVE

- 407** Expectations for the National Spherical Torus Experiments High Harmonic Fast Wave System / *Mark D. Carter, Phillip M. Ryan, David W. Swain*
- 412** Heating and Current Drive Requirements and System Design for the KSTAR Tokamak / *B. G. Hong, Y. D. Bae, J. G. Kwak, C. K. Hwang, B. H. Choi, Y. S. Cho, W. Namkung, M. H. Cho, H. S. Kang, D. W. Swain, H. L. Yang, J. Kim, G. S. Lee*
- 419** High-Field-Side Pellet Injection Technology / *S. K. Combs, L. R. Baylor, C. R. Foust, M. J. Gouge, T. C. Jernigan, S. L. Milora, J.-F. Artaud, A. Géraud*
- 425** Deposition of Fuel Pellets Injected into Tokamak Plasmas / *Larry R. Baylor, T. C. Jernigan, C. Hsieh*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

- 430 Diagnostic Procedure for Two-Stage Light Gas Gun Pellet Injector by Means of Numerical Analysis / *Francesco Angrilli, Mariolino De Cecco, Daniele Pavarin*  
435 Fueling of ITER-Scale Fusion Plasmas / *M. J. Gouge*

### PLASMA FACING COMPONENTS TECHNOLOGY

- 443 Development of High-Z Plasma Facing Components for ITER / *Robert D. Watson, Kevin T. Slattery, Ben C. Odegard, Jr., Chuck H. Cadden, Tim N. McKechnie, Scott O'Dell, Lev Tuchinskiy, Raouf Loutfy, Eugene Dyadko, Suri Sastri, Nilesh Gundaa, Prashant Karandikar*  
454 Comparative Modeling of Particle Deposition and Impurity Generation from Large-Area Inner Walls in Tore Supra, TFTR, JET and DIII-D / *J. T. Hogan, D. Guilhem, J-J. Cordier, C. Skinner, D. Mueller, D. Bashore*  
459 Experimental and Analytical Studies of Louvered First-Wall Systems for NIF / *John M. Scott, Per F. Peterson, Alan Burnham*  
464 Thermal Fatigue Testing of Actively Cooled Divertor Mock-Ups After Neutron Irradiation / *Manfred Roedig, Reiner Duwe, Jochen Linke, Guenther Pott, Bernhard Wiechers*

### NONELECTRICAL APPLICATIONS

- 471 An Alternative, 'Non-Electrical' Pathway for Fusion Energy Development / *Weston M. Stacey*  
477 Non-Electric Applications of Fusion Energy—An Important Precursor to Commercial Electric Power / *G. L. Kulcinski*  
484 Some Near-Term Applications of Fusing Plasmas / *George H. Miley*  
489 Near-Term Applications of Fusion from the ST-VNS Development Path / *E. T. Cheng*  
496 Can Fusion Do Better Than Boil Water for Electricity? / *Lester M. Waganer*

### FUELING AND TRITIUM HANDLING TECHNOLOGY (Poster Session)

- 505 A Real-Time Protection System for the RFX Pellet Injector / *L. Garzotti, P. Innocente, S. Martini*  
510 Long-Term Tritium Accountability Demonstration of ZrCo Storage Bed by "In-Bed" Gas Flowing Calorimetry / *T. Hayashi, T. Suzuki, M. Yamada, M. Nishi*  
515 TPOP-II: Tritium Fueling at a Reactor Scale / *P. W. Fisher, M. J. Gouge*  
521 Tritium Behavior Intentionally Released in the Radiological Controlled Room Under the US-Japan Collaboration at TSTA/LANL / *T. Hayashi, K. Kobayashi, Y. Iwai, T. Yamanishi, M. Nishi, K. Okuno, R. V. Carlson, R. S. Willms, D. Hyatt, B. Roybal*  
526 Mechanism on Change of Tritium Species in Li<sub>2</sub>BeF<sub>4</sub> Molten Salt Breeder Under Neutron Irradiation at Elevated Temperature / *Akihiro Suzuki, Takayuki Terai, Satoru Tanaka*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

- 531** Control Methods of Cryogenic Distillation Column Processing Plasma Exhaust Gas / *T. Yamanishi, Y. Iwai, M. Nishi, H. Yoshida*
- 536** Demonstration of the Integrated Fusion Fuel Loop at the Tritium Process Laboratory of the Japan Atomic Energy Research Institute / *T. Yamanishi, S. Konishi, T. Hayashi, Y. Kawamura, Y. Iwai, T. Maruyama, T. Kakuta, S. O'hira, H. Nakamura, K. Kobayashi, M. Nishi, T. Nagashima, M. Ohta*

### PLASMA ENGINEERING (Poster Session)

- 543** Long Pulse Fusion Physics Experiments Without Superconducting Electromagnets / *Robert D. Woolley*
- 548** Current Profile Reproduction Study on the Basis of a New Expansion Method with the Eigenfunctions Defined in the Tokamak Plasma Interior / *Kenichi Kurihara*
- 553** Estimation of Field Errors at the Port Holes of a Reversed Field Pinch Machine, TPE-RX / *Antonio Masiello, Yasuyuki Yagi, Giuseppe Zollino*
- 558** New Applications of ORNL Neutral Beam Injectors / *C. C. Tsai, G. C. Barber, J. R. Haines, S. L. Milora, Y-K. M. Peng, D. O. Sparks, D. E. Schechter, M. Liniers, M. P. S. Nightingale*
- 564** Measurement of Neutral Beam Profiles at DIII-D / *Henry Chiu*
- 568** Divertor Attached-Detached Operational Space for Safety Analysis of Plasma Transients in ITER / *N. A. Uckan, M. Sugihara, D. Boucher*
- 573** Systems Studies of Lower Cost ITER Options / *J. D. Galambos, D. J. Strickler, N. A. Uckan*

### INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER) (Poster Session)

- 581** Activation Analysis for the ITER Divertor Cassette / *H. Y. Khater, M. E. Sawan*
- 586** Fabrication and Assembly of Full-Scale Sector Models for ITER Vacuum Vessel / *K. Koizumi, N. Nakahira, K. Oka, Y. Itou, H. Takahashi, E. Tada, K. Ioki, G. Johnson, M. Onozuka, Y. Utin, G. Sannazzaro, F. Elio, K. Takahashi*
- 591** Neoclassical Aspects of Transport in ITER Plasmas with High Axial Safety Factors / *W. A. Houlberg, L. R. Baylor*

### SAFETY AND ENVIRONMENT (Poster Session)

- 599** Potential Vacuum Hazards and Proposed Solutions for Personnel Safety During an Air Ingress Accident in ITER / *Lee C. Cadwallader, Cory S. Miller, Kathryn A. McCarthy*
- 604** Tokamak Dust Particle Size and Surface Area Measurement / *William J. Carmack, Galen R. Smolik, Robert A. Anderl, Robert J. Pawelko, Patricia B. Hembree*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

- 609** Decay Heat Analyses for ITER Blanket Designs / *E. T. Cheng, G. Saji*
- 614** Activation and Safety Assessment of the ARIES-ST Design / *H. Y. Khater*
- 619** Industrial Ecology for Inertial Fusion Energy: Selection of High-Z Material for Hylife-II Targets / *Micah D. Lowenthal, Ehud Greenspan, Ralph Moir, William E. Kastenberg, T. Kenneth Fowler*
- 629** Collective Dose Modification upon Inversion of Primary and Secondary Side of the ITER Cooling System Heat Exchangers / *Sandro Sandri, Luigi Di Pace*
- 634** Generation and Characterization of Carbon Particulate in Disruption Simulations / *J. P. Sharpe, M. Bourham, J. G. Gilligan*
- 640** Possibility of Volume Reduction of Blowdown Tank in Fusion Reactor Safety System / *Kazuyuki Takase, Tomoaki Kunugi, Seiichiro Yamazaki, Sadao Fujii*
- 645** Quantitative Measurement of Dust Mobilization in a Vacuum Vessel of a Fusion Reactor During the Loss-of-Vacuum-Accident Event / *Kazuyuki Takase, Tomoaki Kunugi*
- 651** Numerical Simulation of Two-Phase Flow Behavior in a Fusion Reactor During an Ingress-of-Coolant Event / *Kazuyuki Takase*
- 656** Measurement of Biological Half-Life of Tritium in Handling Worker at Fusion Research Facility / *Shigeo Yoshida, Isao Murata, Akito Takahashi*
- 661** Verification of ITER Safety Codes Used in Plasma Transient Analysis / *N. A. Uckan, H. W. Bartels, D. Bouchér, T. Honda*

### MAGNETICS AND SUPERCONDUCTORS (Poster Session)

- 669** Analysis of the Prototype Joints Between Superconducting Cables of ITER CS Coils / *Fabrizio Bellina, Marco Ghin*
- 675** Analysis of Selected Mechanical Details of the ITER Magnet System / *Peter H. Titus*
- 680** Operation with the 1.8 K Tore Supra Cryogenic System / *Bernard Gravil, Denis Henry, Frédéric Minot, Tore Supra Cryogenic Team*
- 684** Design and Model Test of a Water-Cooled VCB for Superconducting Magnet Power Supplies / *M. Matsukawa, Y. Miura, T. Kimura, K. Watanabe, T. Kubota, S. Kawashima*

### NEUTRONICS EXPERIMENTS AND ANALYSIS

- 691** Fusion-Related Materials Decay Heat Evaluation: A Comparison with Experiments / *Dan Gabriel Cepraga, Gilio Cambi, Manuela Frisoni, Franca Carloni*
- 697** X-Ray Surface and Volumetric Heat Deposition and Tritium Breeding Issues in Liquid-Protected FW in High Power Density Devices / *Mahmoud Z. Youssef, Neil Morley, Anter El-Azab*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

- 706 Status of Cross-Section Data for Gas Production from Vanadium and  $^{26}\text{Al}$  from Silicon Carbide in a D-T Fusion Reactor / *Itacil C. Gomes, Donald L. Smith, Edward T. Cheng*
- 714 Experiments on Induced Radioactivity Characteristics of Vanadium Alloy / *Yojiro Ikeda, Fujio Maekawa, Robert Johnson, Yoshimi Kasugai, Yoshitomo Uno, Edward T. Cheng*

### SAFETY AND ENVIRONMENT

- 721 Waste Management Aspects of Low Activation Materials / *E. T. Cheng, P. Rocco, M. Zucchetti, Y. Seki, T. Tabara*
- 728 Tokamak Dust in ITER—Safety Issues and R&D Supporting Dust Limits / *K. A. McCarthy, D. A. Petti, W. J. Carmack, S. V. Gorman*
- 733 Development of the PACTITER Code and Its Application to the Assessment of the ITER Divertor Cooling Loop Corrosion Products / *Luigi Di Pace, Didier Tarabelli, Dominique You*
- 738 Steam Chemical Reactivity of Plasma-Sprayed Beryllium / *Robert A. Anderl, Robert J. Pawelko, Galen R. Smolik, Richard G. Castro*
- 745 Particle Size Distribution of Dust Collected from Alcator C-MOD / *Steven V. Gorman, William J. Carmack, Patricia B. Hembree*

### NATIONAL IGNITION FACILITY-TARGET AREA

- 753 Los Alamos Progress Toward Achieving DT Burn on the National Ignition Facility / *D. C. Wilson, C. Adams, T. Asaki, G. R. Bennett, P. A. Bradley, S. Caldwell, N. D. Delamater, J. C. Fernandez, L. Foreman, S. R. Goldman, J. K. Hoffer, K. Klare, R. Margevicius, D. S. Montgomery, T. J. Murphy, L. Salzer, J. D. Sheliak, D. P. Smitherman, D. Thoma, J. Wallace*
- 760 The Safety and Environmental Process for the Design and Construction of the National Ignition Facility / *Sandra J. Brereton, Jon M. Yatake, Charles A. Taylor*
- 767 Neutron Activation of the NIF Final Optics Assemblies and Their Effect Upon Occupational Doses / *Jeffery F. Latkowski*
- 772 Chamber-Protection Issues for Near-Target Experiments in NIF / *John M. Scott, Per F. Peterson*

### FUSION BLANKET AND SHIELD TECHNOLOGY

- 779 Neutronics Analyses of Tritium Breeding Blanket Performance in a Spherical Torus Based Volumetric Neutron Source / *R. J. Cerbone, E. T. Cheng, Y-K. M. Peng*
- 784 Validation of the ALARA Activation Code / *Paul P. H. Wilson, H. Tsige-Tamirat, Hesham Y. Khater, Douglass L. Henderson*
- 789 Development of Structural Design Criteria for ITER / *Saurin Majumdar*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

### SUPERCONDUCTING MAGNETS AND JOINTS

- 797 ITER Toroidal Field Model Coil (TFMC) Design and Construction / *E. Salpietro*
- 802 Jacketing of the Superconducting Cables for the ITER Central Solenoid Model Coil (CSMC): Lessons Learned, Solved and Open Issues / *Gianni Bevilacqua, Ettore Salpietro, Adamo Laurenti*
- 808 Development and Test of the ITER Conductor Joints for the Central Solenoid / *N. Martovetsky, R. Manahan, R. Jayakumar, P. Michael, C. Y. Gung, J. Minervini, R. Randall, A. Zhukovsky*
- 815 Characterization of Incoloy 9825 and Avoidance of Stress Accelerated Grain Boundary Oxidation (SAGBO) During ITER Model Coil Fabrication / *F. M. G. Wong, N. A. Mitchell, T. Kato, H. Nakajima, R. Randall, M. Morra*

### INERTIAL FUSION TECHNOLOGY

- 825 Systems Analysis and Engineering of the X-1 Advanced Radiation Source / *Gary E. Rochau, Jerome A. Hands, Paul S. Raglin, Juan J. Ramírez*
- 831 IFE Target Injection and Tracking Experiment / *Ronald W. Petzoldt*
- 840 MD Simulation of High Energy Cascades and Damage Accumulation in  $\beta$ -SiC in Inertial Fusion Conditions / *J. Manuel Perlado, Lorenzo Malerba, Tomás Díaz de la Rubia*
- 848 Time Dependent Radiation Transport in Hohlraums Using Integral Transport Methods / *K. R. Olson, D. L. Henderson*

### FUSION BLANKET AND SHIELD TECHNOLOGY (Poster Session)

- 855 Concept Description and Thermalhydraulics of Liquid Surface FW/Blankets for High Power Density Reactors / *A. Ying, N. Morley, K. Gulec, B. Nelson, M. Youssef, M. Abdou*
- 863 Conceptual Design of a Water and Steam Cooled Blanket for the Compact Reversed Shear Tokamak Reactor / *Yoshiyuki Asaoka, Kunihiko Okano, Tomoaki Yoshida, Ken Tomabechi, Yuichi Ogawa, Naoto Sekimura, Yuzo Fukai, Akiyoshi Hatayama, Nobuyuki Inoue, Akira Kohyama, Sei-Ichiro Yamazaki, Seiji Mori*
- 868 Investigation of the Surface Element Composition Influence on Hydrogen Permeability Through Vanadium Alloy VCr4Ti4 / *I. V. Shkolnik, T. V. Kulsartov, I. L. Tazhibaeva, V. P. Shestakov*
- 872 Interaction of Hydrogen Isotopes with Defects in Li<sub>2</sub>O / *Hisashi Tanigawa, Masaki Taniguchi, Satoru Tanaka*
- 877 Effective Thermal Conductivity Measurements of the Binary Pebble Beds by Hot Wire Method for the Breeding Blanket / *Mikio Enoda, Kazuyuki Furuya, Hideyuki Takatsu, Shigeto Kikuchi, Toshihisa Hatano*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

- 882** High Heat Flux Testing and Post-Mortem Observation of Small-Scale ITER First Wall Mock-Up Made by Hip Joining / *Moriyasu Kanari, Toshihisa Hatano, Satoshi Sato, Kazuyuki Furuya, Toshimasa Kuroda, Mikio Enoeda, Hideyuki Takatsu*
- 887** New Insight on Surface Effects of Ceramic Breeder Materials by Means of Work Function Measurement / *Atsushi Suzuki, Tomoya Hiroswa, Kenji Yamaguchi, Michio Yamawaki*
- 892** Fabrication of an ITER Shielding Blanket Prototype / *Satoshi Sato, Toshihisa Hatano, Hideyuki Takatsu, Toshio Osaki, Toshimasa Kuroda, Koichi Yamada, Mikio Enoeda, Shinichi Sato, Kazuyuki Furuya, Yoshihiro Ohara*

### PLASMA FACING COMPONENTS TECHNOLOGY (Poster Session)

- 901** Experimental Investigation into Melt-Layer Erosion of Plasma Facing Materials / *G. E. Dale, M. A. Bourham*
- 908** Fabrication and Thermal Cycle Testing of a First Wall Mock-Up for ITER Baffle Blanket Module / *T. Hatano, S. Suzuki, K. Yokoyama, M. Akiba, J. Ohmori, T. Kuroda, H. Takatsu*
- 914** Study of Particle Reflection by Linear Plasma Facility Map / *Kazuki Kobayashi, Shigeki Ohtsu, Satoru Tanaka*
- 919** Investigation of Hydrogen Permeability Through Copper Alloy CuCr1Zr0.1 and Duplex Structure BE-CU / *T. V. Kulsartov, Y. V. Chikhray, I. L. Tazhibaeva, V. P. Shestakov*
- 924** First-Wall Material/Coolant Heat Flux Limit Comparison / *D. C. Norris, W. M. Stacey, M. Yaksh, S. M. Ghiaasiaan*
- 930** Preliminary Numerical Analysis of Turbulent Heat Transfer in Helium-Cooling Porous Channels for Fusion Reactors / *Kazuyuki Takase*
- 936** Guidelines for an Optimal Design of First Wall Components for RFP Devices / *S. Peruzzo, P. Sonato, P. Zaccaria*
- 941** Tritium Enrichment in the JET Divertor and Its Relation to Tritium Uptake and Retention / *D. L. Hillis, J. T. Hogan, P. Andrew, J. Ehrenberg, M. Groth, M. von Hellermann, L. D. Horton, R. Monk, P. Morgan, M. Stamp*
- 946** Modular Application of Moving-Belt Plasma-Facing Components for Particle and Heat Removal from a Steady-State Fusion System / *Y. Hirooka, M. S. Tillack*

### NEUTRONICS EXPERIMENTS AND ANALYSIS (Poster Session)

- 953** Nuclear Analysis of Bulk Shielding Fusion Integral Experiments on Large SS316/Water Assembly with Simulated Super Conducting Magnet / *Mahmoud Z. Youssef, Anil Kumar, Mohamed A. Abdou, Chikara Konno, Fujio Maekawa, Yujiro Ikeda*
- 964** A Batch Extraction Method for Pulsed Multi-Flux Activation Calculations / *José M. Balmisa, Micah D. Lowenthal, Ehud Greenspan, Javier Sanz, Nathan Stone*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

- 969 ANITA-4/F: A Code for Material Irradiation Characterization in Fusion Neutron Spectra Using FENDL-2 Activation Data / *Dan Gabriel Cepraga, Gilio Cambi, Manuela Frisoni, Gian Carlo Panini*
- 974 A Model for Pulsed Activation Accounting for Circulation, Extraction, and Makeup / *Michiel J. L. de Hoon, Ehud Greenspan, Micah D. Lowenthal*
- 980 Benchmark Experiment on Vanadium Assembly with D-T Neutrons—Leakage Neutron Spectrum Measurement / *Kokooo, I. Murata, D. Nakano, A. Takahashi, F. Maekawa, Y. Ikeda*
- 985 Neutron Activation Cool-Down of the Tokamak Fusion Test Reactor / *H. W. Kugel, G. Ascione, C. Tilson, Jr., A. Kumar*
- 991 Tokamak Applications Related Measurements of Neutron Induced Radioactivity at TFTR / *A. Kumar, H. W. Kugel, G. Ascione*
- 997 Mechanism of Secondary Gamma-Ray Skyshine from Intense 14 MeV Neutron Source Facility with HP-GE Detector / *Isao Murata, Shigeo Yoshida, Noriyuki Saito, Akito Takahashi*
- 1002 Shielding Analyses of the ITER NBI Ports / *Satoshi Sato, Yasushi Seki, Romano Plenteda, Takashi Inoue, Davide Valenza, Robert T. Santoro, Hiromasa Iida, Hideyuki Takatsu, Kohbun Yamada, Yoshihiro Ohara, Toshihisa Utsumi*
- 1008 Self-Shielding Effects in Decay Heat Calculations for Tungsten / *M. E. Sawan, H. Y. Khater, H. Iida, R. T. Santoro*
- 1013 Some Comments for Cross Section Data of Iron Around 15 MeV / *Chikara Konno, Fujio Maekawa, Masayuki Wada, Kazuaki Kosako*
- 1018 Benchmark Experiment on Vanadium-Alloy Assembly with D-T Neutrons—In-Situ Measurement / *Fujio Maekawa, Yoshimi Kasugai, Chikara Konno, Masayuki Wada, Yukio Oyama, Yujiro Ikeda, Robert Johnson, Edward T. Cheng, Mario Pillon, Isao Murata, Kokooo, Daisuke Nakano, Akito Takahashi*
- 1023 Neutronics Experiment to Simulate ITER Shield / *Yuan Chen, Rong Liu, Jian Shen, Haipin Guo, Yuan Liu, Wenmian Jiang*
- 1028 Experimental Studies of Concrete Activation at the National Ignition Facility Using the Rotating Target Neutron Source / *Anthony P. Belian, Jeffery F. Latkowski, Edward C. Morse*

### INERTIAL FUSION (Poster Session)

- 1035 Experimental Investigation of Free Liquid Metal Jets in Vacuum: Preliminary Results for IFE Chamber Wall Protection Applications / *N. B. Morley, A. Y. Ying, A. Gaizer, T. Sketchley, A. I. Konkachbaev, M. A. Abdou*
- 1041 Decommissioning Plan for the National Ignition Facility / *S. Brereton, J. Latkowski, M. Singh, M. Tobin, J. Yatabe*
- 1047 Parametric Studies of Ablation and Venting from the Central Cavity of the HYLIFE-II Reactor / *Caron Jantzen, E. P. Lee, Per F. Peterson*
- 1053 Response of X-1 Experiment Chamber to Target Explosions / *R. R. Peterson, J. F. Santarius*

(Continued)

# CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3

## PART 2

(Continued)

### NUCLEAR TESTING AND DESIGN (Poster Session)

- 1061 Design of the Centerpost for a Spherical Torus Volumetric Neutron Source / *I. N. Sviatoslavsky, E. A. Mogahed, E. T. Cheng, R. J. Cerbone, Y-K. M. Peng, X. R. Wang*
- 1066 Progress of the ST-VNS Study / *E. T. Cheng, R. J. Cerbone, Y-K. M. Peng, J. D. Galambos, D. Strickler, I. N. Sviatoslavsky, C. P. C. Wong, D. K. Sze, X. R. Wang, M. Simnad, M. Tillack*
- 1071 Studies of Inertial Electrostatic Confinement Fusion Neutron Source / *Masami Ohnishi, Kiyoshi Yoshikawa, Yasushi Yamamoto, Kai Masuda, Hisayuki Toku, Mitsunori Hasegawa, Chikara Hoshino, Takahiro Koyama, Kenji Taruya*

### FUSION POWER REACTORS (Poster Session)

- 1079 Loss of Coolant Accident (LOCA) Analysis of the ARIES-ST Design / *E. A. Mogahed, ARIES Team*
- 1084 Three-Dimensional Neutronics Study for ARIES-ST Power Plant / *L. A. El-Guebaly, ARIES Team*
- 1089 Need for Inboard Shield to Protect the Center Post of ST Power Plants / *L. A. El-Guebaly, H. Y. Khater, ARIES Team*

### NATIONAL IGNITION FACILITY—LASER FACILITIES

- 1097 Engineering the National Ignition Facility / *R. Sawicki, J. Bowers, R. Hackel, D. Larson, K. Manes, J. Murray*
- 1105 Flashlamp-Pumped ND: Glass Amplifiers for the National Ignition Facility / *A. Erlandson, T. Alger, J. Horvath, K. Jancaitis, J. Lawson, K. Manes, C. Marshall, E. Moor, S. Payne, L. Pedrotti, S. Rodriguez, M. Rotter, S. Sutton, L. Zapata, S. Seznec, J. Beullier, O. Carbourdin, E. Grebot, J. Guenet, M. Guenet, G. LeTouze, X. Maille*
- 1113 Plasma Electrode Pockels Cell for the National Ignition Facility / *Mark A. Rhodes, Scott Fuchs, Peter Bilton*
- 1117 Beam Control and Laser Characterization for NIF / *Steven J. Boegé, Erlan S. Bliss*
- 1122 Main Amplifier Power Conditioning for the National Ignition Facility / *Mark Newton, Mike Wilson*
- 1127 Phased NIF Start-Up / *M. A. Lane, B. M. Van Wonterghem, C. A. Clower, Jr.*

### REMOTE MAINTENANCE TECHNOLOGY

- 1137 The Remote Exchange of the JET Divertor / *M. A. Pick, JET Team*
- 1144 Remote Handling and Maintenance of ITER In-Vessel Components / *T. Burgess, R. Haange, Y. Hattori, F. Heckendorf, F. Ozaki, K. Shibanuma, A. Tesini, G. Janeschitz, E. Martin, M. Sironi, J. Herndon, D. Maisonnier, E. Tada*

(Continued)

## **CONTENTS / NOVEMBER 1998—VOL. 34, NO. 3 PART 2**

**(Continued)**

- 1151** A Remotely Deployed Laser System for In-Vessel Metrology and Viewing / *Philip T. Spampinato, Robert E. Berry, Madhavan M. Menon, Anthony R. Slotwinski, Donald D. Clemens*
- 1155** An Autonomous Mobile Tracked Vehicle for RFX First Wall Inspection / *S. Dal Bello, P. Gallina, E. Pasqualetto, A. Rossi, G. Marchiori, P. Sonato*
- 1160** Development of Blanket and Divertor Remote Maintenance for ITER / *M. Nakahira, S. Kakudate, K. Oka, N. Takeda, K. Akou, K. Taguchi, Y. Takiguchi, E. Tada, K. Shibanuma, T. Burgess, R. Haange, E. Martin*

### **ALTERNATIVE AND ADVANCED CONCEPTS**

- 1167** LHD-Type Reactor Design Studies / *Akio Sagara, Osamu Motojima*
- 1174** Improved Magnetic Fusion Energy Economics Via Massive Resistive Electromagnets / *Robert D. Woolley*
- 1179** Spherical Tokamak for Material Research / *V. S. Shkolnik, Yu. S. Cherepnin, L. N. Tikhomirov, D. I. Zelenskiy, I. L. Tazhibaeva, V. P. Shestakov, E. P. Velikhov, E. A. Azizov, O. I. Buzhinskiy, A. A. Gostev, G. P. Gardymov, A. Mineev, K. G. Shakhovets*

### **DEPARTMENT**

- 1182** Technical Reviewers
- 1184** Volume 34 Indexes
- xix Volume 34 Contents