

# **Fusion**technology™

**CONTENTS / MARCH 1989—VOL. 15, NO. 2**  
**PART 2A (pp. 225–790)**  
**PART 2B (pp. 791–1358)**

**Proceedings of the**  
**EIGHTH TOPICAL MEETING ON THE TECHNOLOGY**  
**OF FUSION ENERGY**  
**(Salt Lake City, Utah, October 9–13, 1988)**

## **PART 2A**

xiii Comments / *George Miley*

xv Preface: Eighth Topical Meeting on the Technology of Fusion Energy /  
*Clyde R. Toole*

### **OPENING PLENARY SESSION**

227 Progress on Achieving the ICF Conditions Needed for High Gain / *John D. Lindl*

### **RESULTS FROM CURRENT LARGE FUSION EXPERIMENTS**

239 TFTR Results and Plans / *J. C. Sennis, TFTR Group*

245 JET Progress Towards D-T Operation / *M. Huguet, E. Bertolini, JET Team*

259 Forces on the JET Vacuum Vessel During Disruptions and Consequent Operational Limits / *P. Noll, L. Sonnerup, C. Froger, M. Huguet, J. Last*

267 Upgrading the JET Magnet System for 7MA Plasma / *J. R. Last, E. Bertolini, M. Huguet, P. L. Mondino, P. Noll, L. Sonnerup, C. Bell, T. Molyneux*

275 DIII-D Latest Results and Implications / *R. Callis, J. Luxon, T. Scoville, T. Simonen, R. Stambaugh*

281 The Radiological and Shielding Design Aspects of the TFTR DT Operation /  
*Long-poe Ku, Seng-liek Liew*

### **FUSION MATERIALS IRRADIATION AND RESEARCH**

289 A High-Performance D-Lithium Neutron Source for Fusion Technology Testing: Accelerator Driver Design / *George P. Lawrence, Thomas P. Wangler, Stanley O. Schriber, Edwin L. Kemp, Mahlon T. Wilson, Tarlochan S. Bhatia, George H. Neuschaefer, Frank W. Guy, Dale D. Armstrong*

295 IFMIF, An Accelerator-Based Neutron Source for Fusion Components Irradiation Testing Materials Testing Capabilities / *Frederick M. Mann*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 298** Low Temperature Irradiation in FFTF / *J. M. Grover, R. E. Bauer, R. J. Puigh, J. R. Thielges*
- 303** Partitioning of Hydrogen in the Vanadium-Lithium-Hydrogen System at Elevated Temperatures / *A. B. Hull, O. K. Chopra, B. Loomis, D. L. Smith*
- 309** Influence of Carbon and Nitrogen Impurities on the Corrosion of Structural Materials in a Flowing-Lithium Environment / *O. K. Chopra, A. B. Hull*
- 315** The Role of Carbides in the Corrosion Behavior of Fe-12Cr-1MoVW Steel in Liquid Lithium / *G. E. Bell, M. A. Abdou*
- 321** On the Survivability of Diagnostic Windows in the CIT Reactor / *A. Taylor*

### INERTIAL CONFINEMENT FUSION DRIVERS

- 329** Status of Candidate Drivers for a Laboratory Microfusion Facility / *Stephen O. Dean, Alexander J. Glass, Alan Toepfer, Frank D. Feiock, Terry F. Godlove*
- 339** Nd:Glass Laser Technology for ICF Research and Applications / *W. Howard Lowdermilk*
- 350** Design Issues for a Light Ion Beam LMF Driver / *J. J. Ramirez, R. W. Stinnett, D. L. Johnson, C. L. Olson, T. A. Mehlhorn, J. T. Crow, J. P. Quintenz, K. R. Prestwich, M. P. Desjarlais, R. E. Olson, G. O. Allshouse, T. H. Martin, J. P. VanDevender, D. L. Cook, S. A. Slutz, K. B. Coachman, T. R. Lockner, B. N. Turman, S. A. Goldstein, J. N. Olsen, R. R. Peterson, R. L. Engelstad*
- 357** Optical Architecture for a Multi-Megajoule ICF Driver Incorporating Megajoule Class KrF Amplifiers / *John McLeod*
- 364** A Megajoule Class Krypton Fluoride Amplifier for Single Shot, High Gain ICF Application / *Evan Rose, David Hanson, Michael Kang, Burton Krohn, John McLeod*
- 369** Heavy Ion Induction Linac Drivers for Inertial Confinement Fusion / *E. P. Lee, J. Hovingh*
- 377** Solid State Laser Driver for an ICF Reactor / *William F. Krupke*
- 383** Nuclear Pumped Laser for Next Step ICF Driver / *S. Balog, H. Chung, M. Doczy, R. Duraski, M. Hutcheson, L. R. Eglezopoulos, D. Russ*

### PROGRESS TOWARD THE COMPACT IGNITION TOKAMAK

- 391** Tokamak Confinement Projections and Performance Goals / *N. A. Uckan*
- 396** Design Optimization of Ignited Tokamaks / *E. A. Chaniotakis, J. P. Freidberg, D. R. Cohn, L. Bromberg*
- 402** Ignition Experiment in a Single-Turn-Coil Tokamak / *R. Carrera, M. Driga, J. H. Gully, N. E. Hertel, J. Hopf, K. T. Hsieh, E. Montalvo, C. Ordonez, T. Parish, M. N. Rosenbluth, W. A. Walls, W. F. Weldon, M. Werst, H. H. Woodson*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 410 Two-Dimensional Discrete Ordinates Calculations of Prompt Radiation Responses in the 1.75 m CIT / *S. L. Liew, L. P. Ku, C. E. Kessel*
- 416 Analysis of the Compact Ignition Tokamak Heat Removal System Condenser / *K. E. Carlson, T. A. Wareing*
- 421 Safety Analysis of the Compact Ignition Tokamak Radiation Shield / *R. E. Lyon, L. C. Cadwallader*

### FUSION NUCLEONICS

- 429 ENDF/B-VI Nuclear Data Evaluations for Fusion Applications / *C. L. Dunford, D. C. Larson, P. G. Young*
- 440 Evaluation of the  ${}^7\text{Li}(n, n't){}^4\text{He}$  Cross Section for ENDF/B-VI and Application to Uncertainty Analysis / *P. G. Young, J. W. Davidson, D. W. Muir*
- 449 REAC2: Status of Codes and Libraries / *Frederick M. Mann*
- 453 ENDF/B-VI Evaluations for Isotopes of Cr, Fe, Ni, Cu, and Pb / *D. M. Hetrick, C. Y. Fu, D. C. Larson*
- 459 Neutron Transport and Activation Analysis for the IGNITEX Device / *Theodore A. Parish, Rodolfo Carrera, Nolan E. Hertel, Elena Montalvo*
- 465 Potential Applications of Boron-11 in Fusion Reactors / *Gerald R. Domaszek, Theodore A. Parish, Gerald A. Schlapper*
- 469 Aspects of Decay Heat Behavior in Fusion Reactor Blankets / *J. E. Massidda, M. S. Kazimi*
- 475 Neutronics Performance of a Helium-Cooled Solid Breeder Blanket and Shield for ITER / *Yoichi Watanabe, Mahmoud Z. Youssef, Myungdal Song, A. René Raffray*

### PLASMA ENGINEERING

- 483 Plasma Elongation Studies for ITER-Like Tokamaks / *J. D. Galambos, D. J. Strickler, Y-K. M. Peng, R. L. Reid*
- 489 Passive Vertical Stability in the Next Generation Tokamaks / *J. A. Leuer*
- 495 Edge-Plasmas and Wall Protection in RFPs / *K. A. Werley, C. G. Bathke, R. A. Krakowski*
- 501 Confinement and Edge Currents / *John G. Murray*
- 507 Plasma Simulation and Surface Effects in a High-Field Tokamak Ignition Experiment / *C. A. Ordonez, J. Hopf, R. Carrera, E. Montalvo*
- 513 Stability and Erosion of Melt Layers Formed During Plasma Disruptions / *A. M. Hassanein*
- 522 Theoretical and Experimental Studies of the Vapor Shielding Mechanism for Surfaces Subjected to High Heat Fluxes / *J. Gilligan, O. Auciello, M. Bourham, O. Hankins, B. Wehring, D. Hahn, R. Mohanti, J. Stock*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2 PARTS 2A and 2B

(Continued)

- 528 A PC-Based Package for Interactive Assessment of MHD Equilibrium and Poloidal Field Coil Design in Axisymmetric Toroidal Geometry / *W. Keller, D. Steiner*
- 534 A Simple 1-D PC-Based Plasma Edge Engineering Model for Divertor Design Calculations / *Michael D. Baehre, Don Steiner, Mark J. Embrechts*

## THE ICF LABORATORY MICROFUSION FACILITY

- 541 Missions and Design Requirements for a Laboratory Microfusion Facility (LMF) / *William J. Hogan*
- 550 The Laboratory Microfusion Facility Costing Methodology / *D. B. Harris, D. J. Dudziak*
- 557 Analysis of Physical Processes in ICF Target Chambers: Application to the Laboratory Microfusion Facility / *J. J. MacFarlane, R. R. Peterson, G. A. Moses*
- 563 Preventing Vaporization and Destructive Shock Waves in ICF Target-Chamber First Walls / *John H. Pitts, John G. Woodworth, Max Tabak*
- 571 Frost as a First Wall for the ICF Laboratory Microfusion Facility / *Charles D. Orth*
- 578 Final Optic Protection Designs for ICF Containment Chambers / *David G. Nilson, John G. Woodworth*
- 583 Neutronics Analysis of the Laboratory Microfusion Facility / *M. T. Tobin, M. S. Singh, W. R. Meier*
- 590 Overview of the ICF 1000 MJ Experiment Chamber Design / *Dennis Slaughter*
- 595 A Carbon-Carpet First Wall for the Laboratory Microfusion Facility / *M. J. Monsler, W. R. Meier*

## DESIGN OF AN ENGINEERING TEST REACTOR

- 605 System Studies for ITER / *R. L. Reid, Y-K. M. Peng, J. D. Galambos*
- 612 Optimized Multi-Modal-Operation Designs for ITER / *D. T. Blackfield, L. J. Perkins, R. S. Devoto, M. E. Fenstermacher, S. K. Ho*
- 617 Determination of the Required Tritium Breeding Ratio for the Next Fusion Experimental Reactor / *Yoichi Watanabe, Mohamed A. Abdou, Mahmoud Z. Youssef*
- 623 Application of Uncertainty Analysis of Ignition Performance to the Engineering Test Reactor / *S. K. Ho, L. J. Perkins*
- 629 Transport Analysis of Ignited and Current-Driven ITER Designs / *S. E. Attenberger, W. A. Houlberg, N. A. Uckan*
- 637 Lifetime Analysis of the ITER First Wall and Divertor Plates / *R. F. Mattas*
- 643 An Aqueous Lithium Salt Self-Cooled Blanket and Shield for ITER / *M. E. Sawan, I. N. Sviatoslavsky, G. L. Kulcinski*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

**649** Impact of Maintainability on the International Thermonuclear Experimental Reactor (ITER) Configuration Options / *D. C. Lousteau*

**654** A High-Recycle Divertor for ITER / *K. A. Werley, C. G. Bathke*

### BLANKET AND SHIELD DESIGN

**663** Helium-3 Blankets for Tritium Breeding in Near-Term and Commercial Fusion Systems / *D. Steiner, M. J. Embrechts, G. Varsamis, R. Vesey, P. Gierszewski*

**669** A New Water-Cooled Lead Blanket Concept / *E. T. Cheng, R. L. Creedon, C. P. C. Wong, D-K. Sze*

**674** Rotating Liquid Blanket with No First Wall for Fusion Reactors / *Ralph W. Moir*

**680** The Breeder Blanket Interface (BBI) to TSTA: Requirements for an Aqueous Lithium Salt Blanket / *P. A. Finn, R. G. Clemmer, L. Greenwood, A. Lide, D. K. Sze, J. L. Anderson, R. Sherman, J. R. Bartlit, Y. Naruse, H. Yoshida*

**687** Coolant Leakage Through Cracks in Fusion Reactors / *A. M. Hassanein*

**695** Thermal Resistance Gaps for Solid Breeder Blankets Using Packed Beds / *Z. R. Gorbis, A. R. Raffray, M. S. Tillack, M. A. Abdou*

**699** MHD Flow in Insulating Circular Ducts for Fusion Blankets / *T. Q. Hua, J. S. Walker*

**705** Sidewall Flow Instabilities in Liquid Metal MHD Flow Under Blanket Relevant Conditions / *C. B. Reed, B. F. Picologlou*

### PLASMA HEATING AND CURRENT DRIVE—I

**719** The Technology of the Ion Cyclotron Range of Frequencies / *D. J. Hoffman, G. C. Barber*

**725** A Survey of ECH Microwave Technology / *Charles P. Moeller*

**734** RF Accelerated High Energy (1–3 MeV) Neutral Beams for Tokamak Plasma Heating, Current Drive and Alpha Diagnostics / *W. R. Becraft, J. H. Whealton, T. P. Wangler, A. Schempp, G. E. McMichael, M. A. Akerman, G. C. Barber, W. K. Dagenhart, H. H. Haselton, R. J. Raridon, K. E. Rothe, P. M. Ryan, B. D. Murphy, W. L. Stirling*

**740** A Non-Inductively Driven Tokamak Reactor Based on ITER / *M. E. Fenstermacher, R. S. Devoto, R. H. Bulmer, J. D. Lee, J. R. Miller, J. H. Schultz*

### ICF REACTORS AND TECHNOLOGY

**749** Advances in Commercial ICF Technology Since 1986 / *G. L. Kulcinski*

**756** Overview of the LIBRA Light Ion Beam Fusion Conceptual Design / *G. A. Moses, G. L. Kulcinski, D. Bruggink, R. Engelstad, E. Lovell, J. MacFarlane, Z. Musicki, R. Peterson, M. Sawan, I. Sviatoslavsky, L. Wittenberg, G. Kessler, U. von Möllendorff, E. Stein, D. Cook, R. Olson, I. Smith, P. Corcoran, H. Nishimoto, J. Fockler*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 766** Chamber Design for the LIBRA Light Ion Beam Fusion Reactor / *M. E. Sawan, I. N. Sviatoslavsky, L. J. Wittenberg, E. G. Lovell, R. L. Engelstad*
- 772** Parametric Design Space and Nuclear Analysis of a Nuclear-Pumped-Laser-Driven ICF Reactor / *D. E. Beller, F. Whitworth, Jr., G. H. Miley*
- 778** Overview of Target Fabrication for LMF / *Monya A. Lane*
- 783** Transient Condensation of Vapor Using a Direct Simulation Monte Carlo Method / *M. M. El-Afify, M. L. Corradini*

### PART 2B

#### SAFETY AND ENVIRONMENT—I

- 793** Fusion Safety and Environmental Performance Goals / *S. J. Piet, D. F. Holland*
- 803** A First Approach to the Safety Analysis of a Tokamak Test Reactor by a System Study Methodology / *A. Boschi, T. Palma, S. Sarto, G. Cambi, G. Zappellini, H. Djerassi, J. Rouillard*
- 809** Probabilistic Failure Analysis of Fusion Reactor First Walls / *D. A. O'Brien, D. Steiner*
- 815** Critical Safety Function Guidelines for Experimental Fusion Facilities / *L. C. Cadwallader*
- 821** LOCA Study for a Helium-Cooled Solid Breeder Design for ITER / *Z. R. Gorbis, A. R. Raffray, K. Fujimura, I. Jun, M. A. Abdou*
- 827** Thermal Limits for Passive Safety of Fusion Reactors / *M. S. Kazimi, J. E. Massidda, M. Oshima*
- 833** Explosion Hazard in Liquid Nitrogen Cooled Fusion Systems / *Sandra J. Brereton*
- 839** The Consequences of Lithium Fires in the Presence of Steam / *D. S. Barnett, M. S. Kazimi*

#### ITER NUCLEAR DESIGN

- 849** U.S. ITER Shield and Blanket Design Activities / *C. C. Baker, U.S. ITER Group*
- 858** Helium-Cooled Solid Breeder Blanket for ITER / *A. R. Raffray, M. A. Abdou, P. Chou, Z. Gorbis, M. Tillack, Y. Watanabe, A. Ying*
- 864** Water-Cooled Solid-Breeder Blanket Concept for ITER / *Y. Gohar, C. C. Baker, H. Attaya, M. Billone, R. C. Clemmer, P. A. Finn, A. Hassanein, C. E. Johnson, S. Majumdar, R. F. Mattas, D. L. Smith, H. Stevens, D. K. Sze, L. R. Turner*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 871** A Li-Particulate Blanket Concept for ITER / *C. P. C. Wong, E. T. Cheng, R. L. Creedon, K. R. Schultz, G. Thurston, Y. Gohar, C. Baker, H. Attaya, M. Billone, A. Hassanein, C. Johnson, S. Majumdar, R. Mattas, D. Smith, D-K. Sze*
- 876** Helium-Cooled Lithium Compound Suspension Blanket Concept for ITER / *Y. Gohar, C. C. Baker, H. Attaya, M. Billone, R. C. Clemmer, P. A. Finn, A. Hassanein, C. E. Johnson, S. Majumdar, R. F. Mattas, D. L. Smith, H. Stevens, D. K. Sze, L. R. Turner*
- 881** Tungsten Versus Steel in Inboard Shield of ITER: Impact on Magnet Damage, Reactor Size, and Cost / *Laila A. El-Guebaly, Mohamed E. Sawan*
- 887** Comparison of PCA Versus Tungsten in TIBER-II In-Board Shield and Impact of Nuclear Data Uncertainties on Machine Cost / *Mahmoud Z. Youssef, Insoo Jun*
- 893** Activation Characteristics of Different Steel Alloys Proposed for Near Term Fusion Reactors / *H. Attaya, Y. Gohar, D. Smith, C. Baker*
- 900** Activation Analysis for the Aqueous Self-Cooled Blanket and Shield of ITER / *H. Y. Khater, M. E. Sawan, S. W. Lomperski, I. N. Sviatoslavsky*

### MAGNET ENGINEERING, DESIGN AND EXPERIMENTS—I

- 909** International Development of Superconducting Magnets for Fusion Power / *P. N. Haubenreich, S. Shimamoto, P. Komarek, G. Vécsey*
- 915** Design Considerations for ITER Magnet Systems / *C. D. Henning, J. R. Miller*
- 922** Poloidal Field System Analysis and Scenario Development for ITER / *Joel H. Schultz, R. Bulmer, J. Miller*
- 928** Design and R&D for the 22 T Central Solenoid for CIT / *R. J. Thome, R. D. Pillsbury, Jr., E. S. Bobrov, J. Feng, R. Vieira*
- 933** An Eigenexpansion Technique for Modelling Plasma Start-Up / *R. D. Pillsbury, Jr.*
- 938** Design and Manufacture of the RFX Magnetizing Winding / *F. Bellina, M. Guarnieri, A. Stella, G. Ferri, J. Rauch, T. Roman*
- 945** MSCAP Simulations of TESPE Magnet Safety Transients / *J. S. Herring, K.-P. Jüngst, J. L. Jones, H. G. Kraus*
- 951** On the Consequences of Electrical Failures of PF Magnet Systems for Fusion Reactors / *M. Zimmermann, M. S. Kazimi, N. O. Siu, R. J. Thome*
- 957** A Commercial Tokamak Reactor Using Super High Field Superconducting Magnets / *J. Schwartz, L. Bromberg, D. R. Cohn, J. E. C. Williams*

### SAFETY AND ENVIRONMENT—II

- 967** Lithium-Mixed Gas Reactions / *D. S. Barnett, T. K. Gil, M. S. Kazimi*
- 973** Large Scale Li<sup>17</sup>Pb<sup>83</sup>/Water Interaction Studies / *O. Kranert, H. M. Kottowski, C. Savatteri*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2 PARTS 2A and 2B

(Continued)

- 979 Lithium-Lead/Water Reaction Experiments and Analysis / *J. P. Herzog, M. L. Corradini*
- 984 Some Safety Considerations for Steam Coolant with Liquid Metal Breeders / *D. W. Jeppson*
- 990 Accommodation of Liquid Metal by Cavity Liners / *D. W. Jeppson*
- 996 Safety Comparison of Fusion Fuel Cycles / *Sandra J. Brereton, John E. Massidda, Mujid S. Kazimi*
- 1003 Assessment of the MHD Capability in the ATHENA Code Using Data from the ALEX Facility / *Paul A. Roth*
- 1008 Integrity of Plasma Vacuum Boundary in Loss-of-Coolant Accident / *S. Kobayashi, T. Shimizu, Y. Seki*

## MAGNET ENGINEERING DESIGN AND EXPERIMENTS—II

- 1015 Tokamak Coil Current Trajectories Including Structure / *C. E. Kessel*
- 1021 Application of High Temperature Ceramic Superconductors (CSC) to Commercial Tokamak Reactors / *D. A. Ehst, S. Kim, Y. Gohar, L. Turner, D. L. Smith, R. Mattas*
- 1032 Design Development and Construction of the RFX Field Shaping Winding / *G. Chitarin, M. Guarnieri, A. Stella*
- 1039 Electromechanical Analysis of the Technology Demonstrator for the IGNITEX Fusion Device / *M. D. Driga, K. T. Hsieh, W. F. Weldon, M. D. Werst*
- 1046 Comparison of Nb<sub>3</sub>Sn and NbTi Superconductor Magnet ITER Devices / *J. D. Galambos, Y-K. M. Peng, R. L. Reid, M. S. Lubell, L. Dresner, J. R. Miller*
- 1051 Estimation of Toroidal Field Coil Stresses from Magnetic Loads in FER and NET by Analytic Methods / *Bernard W. Riemer*
- 1058 Rectifier Transformer Saturation on Commutation Failure / *E. Lu, G. Bronner*
- 1064 STX Magnet Fabrication and Testing to 16 T / *T. J. McManamy, R. D. Benson, R. L. Brown, G. H. Henkel, E. A. Lazarus, D. E. Williamson, C. T. Wilson, Jr.*

## PLASMA HEATING AND CURRENT DRIVE—II

- 1071 Neutral Beam Penetration Considerations for CIT / *J. Wei, L. Bromberg, R. C. Myer, D. R. Cohn*
- 1076 Ignition and Steady-State Current Drive Capability of INTOR Plasma / *N. A. Uckan*
- 1082 Technology and Physics Implications of Oscillating-Field Current Drive in Reversed-Field Pinches / *C. G. Bathke, R. A. Krakowski, K. F. Schoenberg*

(Continued)



# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 1088** Resonant Double Loop Antenna Development at ORNL / *D. J. Taylor, F. W. Baity, R. A. Brown, W. E. Bryan, A. Fadnek, D. J. Hoffman, J. F. King, R. L. Livesey, R. L. McIlwain*
- 1093** Materials Tests and Analyses of Faraday Shield Tubes for ICRF Antennas / *J. F. King, F. W. Baity, D. J. Hoffman, J. C. Walls, D. J. Taylor*
- 1097** Neutral Particle Beam Alternative Concept for ITER / *D. Sedgley, J. Brook, T. Luzzi, L. Deutsch*

### ALTERNATE FUELS AND INNOVATIVE CONFINEMENT CONCEPTS

- 1107** Space Applications of Fusion Energy Part II—Factors Affecting Confinement Concept / *J. Reece Roth*
- 1108** Terrestrial Sources of Helium-3 Fusion Fuel—A Trip to the Center of the Earth / *Layton J. Wittenberg*
- 1114** PACER Revisited / *Ralph W. Moir*
- 1119** Magnetic Cusp Contours and Measured ECRH Surfaces / *M. A. Prelas, E. Leal-Quiros, J. F. Kunze, F. P. Boody, W. Miller, M. Mosquera, J. Javedani, T. Pennington, R. Hane, W. Wei, J. Burnett, T. J. Dolan, A. Gu*
- 1125** An Analysis of Tritium and Fissile Fuel Exchange in Fusion-Fission Systems / *Brent L. Rice, Theodore A. Parish*
- 1130** Neutron Production by Reversed Field Pinches / *T. J. Dolan, J. C. DeVeaux*
- 1136** PLASMAK<sup>®</sup> Star Power for Energy Intensive Space Applications / *P. M. Koloc*
- 1142** D-3He Fuel Cycles for Neutron Lean Reactors / *W. Kernbichler, G. H. Miley, M. Heindler*
- 1148** Status of the Field-Reversed Configuration as an Alternate Confinement Concept / *M. Tuszewski*
- 1154** Fusion Space Propulsion with a Field Reversed Configuration / *R. Chapman, G. H. Miley, W. Kernbichler, M. Heindler*

### BLANKET LIQUID METAL MHD

- 1163** Numerical Method for Fluid Flow and Heat Transfer in Magneto-hydrodynamic Flow / *C. N. Kim, M. A. Abdou*
- 1169** The Effect of Hartmann and Side Layers on Heat Transfer in Magneto-hydrodynamic Flow / *A. Ying, A. S. Lavine, M. Tillack*
- 1174** Heat Transfer in Rectangular First Wall Coolant Channels of Liquid-Metal-Cooled Blankets / *T. Q. Hua, B. F. Picologlou*
- 1180** Experimental Investigations of MHD Flow Tailoring for First Wall Coolant Channels of Self-Cooled Blankets / *B. F. Picologlou, C. B. Reed, T. Q. Hua, L. Barleon, H. Kreuzinger, J. S. Walker*

(Continued)

# CONTENTS / MARCH 1989—VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 1186** The Design of a Heat Transfer Liquid Metal MHD Experiment for ALEX / *B. F. Picologlou, C. B. Reed, T. Q. Hua, A. S. Lavine*
- 1192** Thermomechanical Aspects of the Liquid Metal Cooled Limiter / *A. Majid, M. A. Abdou*
- 1196** Evaluation of Liquid Metal Protection of a Limiter/Divertor in Fusion Reactors / *A. M. Hassanein, D. L. Smith*

### BLANKET MATERIALS

- 1205** Mechanical Performance of Fusion Solid Breeder and Multiplier Materials / *M. C. Billone, W. T. Grayhack*
- 1212** Measurements of Adsorption in the LiAlO<sub>2</sub>-H<sub>2</sub>O(g) System / *Albert K. Fischer, Carl E. Johnson*
- 1217** Modeling Unusual Tritium Release Behavior from Li<sub>2</sub>O / *J. P. Kopasz, S. W. Tam, R. A. Verrall*

### COMMERCIAL REACTORS, ECONOMICS AND POWER CONVERSION

- 1225** Economic Implications for Fusion Derived from ESECOM Study / *J. G. Delene, R. A. Krakowski*
- 1233** APOLLO—An Advanced Fuel Fusion Power Reactor for the 21st Century / *G. L. Kulcinski, G. A. Emmert, J. P. Blanchard, L. A. El-Guebaly, H. Y. Khater, J. F. Santarius, M. E. Sawan, I. N. Sviatoslavsky, L. J. Wittenberg, R. J. Witt*
- 1245** Design and Cost Evaluation of a Generic Magnetic Fusion Reactor Using the D-D Fuel Cycle / *T. E. Shannon*
- 1254** Advanced Fusion MHD Power Conversion Using the CFAR Cycle Concept / *M. A. Hoffman, R. Campbell, B. G. Logan*
- 1270** Power Conversion Options for the Cascade ICF Power Reactor / *R. F. Bourque*
- 1275** Energy Conversion Systems Design for Fusion Reactors / *A. E. Dabiri*

### BLANKET NUCLEONICS EXPERIMENTS

- 1283** Tritium Production-Rate Distributions in a Be-Sandwich Lithium-Oxide Cylindrical Assembly / *H. Maekawa, S. Yamaguchi, Y. Oyama, K. Kosako*
- 1287** Determination of Neutron Spectrum in D-T Fusion Field by Foil Activation Technique / *Y. Ikeda, C. Konno, Y. Oyama, K. Oishi, T. Nakamura*
- 1293** Phase-II B Experiment of JAERI/USDOE Collaborative Program on Fusion Blanket Neutronics / *Y. Oyama, S. Yamaguchi, K. Tusda, Y. Ikeda, C. Konno, H. Maekawa, T. Nakamura, K. G. Porges, E. F. Bennett, R. F. Mattas*

(Continued)

# CONTENTS / MARCH 1989–VOL. 15, NO. 2

## PARTS 2A and 2B

(Continued)

- 1299** Comparative Analysis for Phase IIA and IIB Experiments of the U.S./JAERI Collaborative Program on Fusion Blanket Neutronics / *M. Z. Youssef, Y. Watanabe, M. Abdou, M. Nakagawa, T. Mori, K. Kosako, T. Nakamura*
- 1309** Analysis for the Selection of Experimental Configurations for Heterogeneity and Be Multi-Layered Experiments of U.S.DOE/JAERI Collaborative Program on Blanket Neutronics / *Anil Kumar, Yoichi Watanabe, Mahmoud Z. Youssef, Mohamed A. Abdou*
- 1315** Results from Recent Experiments at the LOTUS Facility / *A. Kumar, C. Sahraoui, S. Azam*

### TRITIUM TECHNOLOGY

- 1327** Recent Results at the Tritium Systems Test Assembly / *J. L. Anderson, J. R. Bartlit*
- 1331** Atmospheric Detritiation System Performance / *Glen R. Longhurst, Roland A. Jalbert, Richard L. Rossmassler*
- 1337** Study on Sorption of Tritium on Various Material Surfaces and Its Application to Decontamination of Tritium-Sorbing Materials / *Nobuyuki M. Masaki, Takakuni Hirabayashi, Masakatsu Saeki*
- 1343** The Importance of Metal Oxides on the Reaction Between Oxygen and Tritium on Stainless Steel / *P. A. Finn, E. H. Van Deventer*
- 1349** A Fast Neutron, In Situ Tritium Recovery Experiment on Solid Breeder Materials / *G. W. Hollenberg, T. Kurasawa, H. Watanabe, S. E. Berk, I. J. Hastings, J. Miller, Donald E. Baker, Roger E. Bauer, Raymond J. Puigh*

### DEPARTMENT

- 1355** Author Index