Fusion Technology

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FUSION REACTORS

FRACTIONAL POWER OPERATION OF TOKAMAK REACTORS: ISSUES AND PROSPECTS

TOKAMAK POWER REACTOR IGNITION AND TIME-DEPENDENT FRACTIONAL POWER OPERATION

Tak Kuen Mau
Erik L. Vold
Robert W. Conn

Tak Kuen Mau (top) [PhD, electrical engineering, University of Wisconsin (UW), 1977] is currently a principal development engineer in the Fusion Engineering and Physics Program at the University of California, Los Angeles (UCLA). He is also a staff member with the continuous current tokamak program in the Tokamak Fusion Laboratory. He spent from 1978 through 1979 as a research associate in the nuclear engineering department at UW, Madison. His main research interests include wave propagation and heating in plasmas, antenna design, radio-frequency current drive, fusion reactor physics, and numerical modeling. **Erik L. Vold** (center) [MS, health physics, UW, 1977; MS, engineering, University of California, Davis, 1982] is in the TRW doctoral fellowship program at UCLA, majoring in applied plasma physics. He has worked in several areas related to fusion reactors including tritium breeding analyses, neutron activation studies of blankets, and time-dependent tokamak plasma burn simulations. His current research involves modeling of a reactor plasma edge including self-consistent treatment of neutrals and electric fields. **Robert W. Conn** (bottom) (PhD, California Institute of Technology, 1968) spent 1 year at the Joint Euratom Nuclear Research Center at Ispra, Italy, and 1 year at the Brookhaven National Laboratory before joining UW in 1970. While at UW, he served as a professor of nuclear engineering and as director of the fusion engineering program. Since 1980, he has been a member of the UCLA faculty as professor of engineering and applied science, and since 1982, he has been co-director of UCLA's Center for Plasma Physics and Fusion Engineering. His primary research interests include plasma physics, plasma/surface interactions, fusion reactor design, and reactor plasma analysis.

THREE-CELL, LARGE-MIRROR-RATIO TANDEM MIRROR MAGNETIC DESIGN STUDIES

G. L. Francis
J. R. Myra
D. A. D'Ippolito
P. J. Catto
R. E. Aamodt

G. L. Francis (photo not available) (MA, University of Colorado, 1977) is a scientific staff member at the Plasma Research Institute (PRI) of Science Applications International Corporation (SAIC) in Boulder, Colorado. He is responsible for the design and implementation of many of the computer codes developed at PRI. In recent years, he has worked primarily on

the problems of neoclassical transport and magnetic optimization of tandem mirrors. **J. R. Myra** (photo not available) (PhD, University of Maryland, 1979) is a senior research scientist at SAIC/PRI. His research interests include a number of nonlinear plasma wave problems, linear magnetohydrodynamics (MHD) and microstability, and transport theory of fusion plasmas. **D. A. D'Ippolito** (photo not available) (PhD, University of Maryland, 1975) is a senior research scientist at SAIC/PRI. His recent research has covered many aspects of tandem mirror design including MHD equilibrium and stability, magnetic optimization, and nonlinear ion cyclotron resonance frequency physics. Previously, he has worked on the theory of tokamaks, pinches, and multipoles. **P. J. Catto** (photo not available) (PhD, Yale University, 1972) is a senior research scientist at SAIC/PRI. He has research experience in the fields of tokamak, mirror, and bumpy torus fusion devices and laser ignited fusion. In recent years, his research interests have included many aspects of equilibrium, transport, and stability theory. **R. E. Aamodt** (photo not available) (PhD, University of Michigan, 1962) is the director of the PRI at SAIC. His research interests include a number of areas in plasma physics, applied mathematics, and nonlinear phenomena.

ECONOMIC CONSIDERATIONS OF COMMERCIAL TOKAMAK OPTIONS

Ali E. Dabiri

Ali E. Dabiri (BS, engineering, Teheran Polytechnic, 1967; MS, 1969, and ScD, 1971, engineering, Massachusetts Institute of Technology) is a senior scientist at Science Applications, Inc. He has worked on many aspects of fusion engineering issues including first-wall and blanket design of alternative fusion fuel reactors. He is currently involved in compact fusion reactor studies. Past work includes gas/solid interactions, energy conservation, and energy systems.

PLASMA ENGINEERING

SELF-IGNITION OF AN ADVANCED FUEL FIELD-REVERSED CONFIGURATION REACTOR BY FUSION PRODUCT HEATING

Masami Ohnishi
Shoichi Ohi
Masao Okamoto
Hiromu Momota
Jiro Wakabayashi

Masami Ohnishi (top) (Dr. Eng., electrical engineering, Kyoto University, Japan, 1979) is a research associate at the Institute of Atomic Energy, Kyoto University. He was a visiting assistant professor in the Nuclear Engineering Program of the University of Illinois from April 1979 for 6 months and held a visiting appointment at Lawrence Livermore National Laboratory from October 1979 to April 1980. His current interests include alpha-particle transport in magnetic fusion, dynamics and control of fusion reactors, and reactor design studies of open-ended systems. **Shoichi Ohi** (center) (Dr. Eng., welding engineering, Osaka University, Japan, 1972) is an associate professor at the Plasma Physics Laboratory, Faculty of Engineering, Osaka University. He has researched the formation, translation, and transport of field-reversed configuration plasmas. **Masao Okamoto** (bottom) (Dr. Eng., nuclear engineering, Kyoto University, Japan, 1971) is an associate professor at the Institute of Plasma Physics (IPP), Nagoya University and holds the portfolio of an associate professor at the Institute of Atomic Energy, Kyoto University. His

current interests include magnetohydrodynamics (MHD) and transports in magnetic fusion. **Hiromu Momota** (top) (PhD, plasma physics, Kyoto University, Japan, 1966) is a professor at the IPP. He has been working on the microinstabilities and stochastic phenomena of confined plasmas, and the development of superconducting coils. He is now interested in the advanced fusion fuel cycles using the field-reversed mirror configuration and the stabilization of its MHD modes by means of energetic particle beams. **Jiro Wakabayashi** (bottom) (BS, 1951, and D. Eng., 1959, electrical engineering, Kyoto University, Japan) is a professor at the Institute of Atomic Energy, Kyoto University. His current research interests are the dynamics, control, and instrumentation of nuclear power plants. He is also interested in computer applications for increasing plant reliability and supporting operation at the usual operating state and accident moment. Most of his works are analytical studies and computer simulations.

EXPERIMENTAL DEVICES

DESIGN AND FABRICATION OF THE MULTIPINCH EXPERIMENTAL DEVICE

Brian Curwen
Donald W. Graumann
Robert J. La Haye

Brian Curwen (top) (BSC, mechanical engineering, Manchester University, United Kingdom, 1960) has been associated with GA Technologies, Inc. (GA) since 1975, initially working in the area of gas-cooled fission reactor design. He has been involved in the design and assembly of fusion experimental devices since 1980, and was the chief mechanical engineer on the Ohmically Heated Toroidal Experiment (OHTE) and the multipinch Reversed-Field Pinch (RFP) experiment. **Donald W. Graumann** (center) (MS, mechanical engineering, University of California, Berkeley, 1965) has been involved in fusion reactor engineering studies and experiments at GA since 1975. He served as engineering manager on the OHTE program and was responsible for engineering design and fabrication of the OHTE and multipinch devices. **Robert J. La Haye** (bottom) (PhD, physics, City University of New York, 1975) joined GA in 1975 and has conducted plasma physics research on a wide range of experimental devices. He has worked on the dc octopole, the Doublet II-A tokamak, and the OHTE RFP, and was operations manager of the multipinch RFP experimental program.

SHIELDING

MEASUREMENTS OF THE NEUTRON AND GAMMA-RAY FLUENCES IN THE TFTR TEST CELL DUE TO A POINT SOURCE SIMULATING D-T FUSION PLASMA NEUTRON PRODUCTION

J. K. Dickens
J. W. McConnell
K. M. Chase
H. W. Hendel
E. B. Nieschmidt
Francis Y. Tsang

J. K. Dickens (top) (PhD, nuclear physics, University of Southern California, 1962) is a group leader in the Engineering Physics and Mathematics Division at Oak Ridge National Laboratory (ORNL). His research activities include measurements at the Oak Ridge Electron Linear Accelerator facility of nuclear data applicable to analyses of shielding of and radiation damage to equipment found in high-energy neutron environments of a fusion system. **J. W. McConnell** (bottom) (MS, electrical engineering,

University of Tennessee, Knoxville, 1962) is a research staff member of the Physics Division at ORNL. His current research is in electronic design for computer-controlled data acquisition at the Holifield Heavy-Ion Research Facility. **K. M. Chase** (top right) (Assoc. Deg., engineering, DeVry Institute, 1979) is a health physics technician at the Princeton Plasma Physics Laboratory (PPPL). **H. W. Hendel** (top left) (PhD, physics, Technical Institute Munich, Federal Republic of Germany, 1953) is a principal research physicist at the PPPL, on leave from the RCA David Sarnoff Research Center, Princeton, New Jersey. His main field of research is the study of neutron source strength on the Tokamak Fusion Test Reactor (TFTR). **E. B. Nieschmidt** (bottom right) (MS, physics, San Diego State University, 1961) is a scientific specialist at the Idaho National Engineering Laboratory, on leave to the PPPL. His main interest is neutron activation neutron source strength measurement on the TFTR. **Francis Y. Tsang** (bottom left) (BS, physics, and BS, chemistry, Eastern Oregon State College, 1974; MS, 1976, and PhD, 1978, nuclear engineering, University of Missouri–Columbia) has been involved in the development of fusion reactor blanket dosimetry since 1980. His current research activities include active and passive radiation measurement techniques and neutron and photon interactions with fissile and fertile materials.

PLASMA HEATING SYSTEMS

ADVANCED TOROIDAL FACILITY NEUTRAL BEAM INJECTION: OPTIMIZATION OF BEAM ALIGNMENT AND APERTURING

Robert N. Morris
R. H. Fowler
James A. Rome
T. J. Schlagel

Robert N. Morris (top right) (BS, electrical engineering, Wayne State University, 1978; MS, 1979, and PhD, 1984, Georgia Institute of Technology) is a computational physicist in the Computing and Telecommunications Division at Oak Ridge National Laboratory (ORNL). He is currently involved in the alignment of the Advanced Toroidal Facility coil sets, the beam-line systems, and the positioning of plasma diagnostics. **R. H. Fowler** (top left) (BS, physics, University of Georgia, 1963; MS, 1965, and PhD, 1968, physics, Clemson University) is head of the computational physics department of the Computer Sciences Division at ORNL. For several years he was involved in the computation of the properties of gases and liquids from intermolecular interactions. Currently, his primary area of work is in the computational modeling of energetic particle effects in tokamaks. **James A. Rome** (bottom right) (BS, MS, and ScD, Massachusetts Institute of Technology) has been a senior scientist in the Fusion Energy Division of ORNL for 15 years. **T. J. Schlagel** (bottom left) [BA, physics, Carleton College, 1984; MS, physics, University of Illinois, Urbana-Champaign (UIUC), 1985] is working on his PhD in nuclear theory at UIUC.

ION CYCLOTRON RANGE OF FREQUENCIES ANTENNA DESIGN FOR R TOKAMAK

Eiji Kako
Ritoku Ando
Makoto Ichimura
Yuichi Ogawa
Tsuneo Amano
Tetsuo Watari

Eiji Kako (right) (BS, Mie University, Japan, 1979) is a member of the JIPP T-IIU Group at the Institute of Plasma Physics (IPP), Nagoya University. He has worked on the radio-frequency technology for ion cyclotron range of frequencies (ICRF) heating

since 1981. **Ritoku Ando** (top right) (MS, physics, Nagoya University, Japan, 1985) is a student of the graduate school at Nagoya University. His interests include ICRF current drive experiments. **Makoto Ichimura** (top left) (PhD, engineering, University of Tokyo, Japan, 1978) is an assistant professor at the Plasma Research Center, University of Tsukuba, Japan. His research interests include experimental studies on plasma heating by using ICRF. **Yuichi Ogawa** (center right) (PhD, engineering, University of Tokyo, Japan, 1981) is a research scientist at the IPP, Nagoya University. He has worked on tokamak experiments with the JIPP T-IIU device since 1985. **Tsuneo Amano** (bottom left) (PhD, physics, Kyoto University, Japan, 1962) is a professor at the IPP, Nagoya University. He has worked on the magnetohydrodynamic stability and transport theory of tokamak, reversed-field pinch, and helical systems. **Tetsuo Watari** (bottom right) (PhD, engineering, University of Tokyo, Japan, 1973) is an associate professor at the IPP, Nagoya University. He has been involved in the ICRF heating experiment on JIPP T-IIU since 1981.

BLANKET ENGINEERING

AN ANALYTICAL FORMULA FOR CALCULATING THE TRITIUM BREEDING RATIO IN FUSION REACTOR BLANKETS

Koichi Maki

Koichi Maki (BS, nuclear engineering, Tokyo University, Japan, 1968; MS, nuclear engineering, Kyoto University, Japan, 1971) is a researcher at Energy Research Laboratory, Hitachi, Ltd. He worked in fields of nuclear force and fast breeder reactor physics. His research interests are neutronics and plasma transport simulation in fusion reactors.

PLASMA ENGINEERING

ENHANCED MIGMA AND NUCLEAR SAFETY

J. Rand McNally, Jr.

J. Rand McNally, Jr. (PhD, physics, Massachusetts Institute of Technology, 1943) is retired from the senior research staff in the Fusion Energy Division of Oak Ridge National Laboratory. His research interests include atomic physics, plasma physics, and nuclear fusion in which fields he has published well over 100 technical articles. He is now a fusion energy consultant.