

TABLE OF CONTENTS

OPENING CEREMONY

Welcoming Remarks and Introduction of Keynote Speaker:

Sun W. Chun, Director

US Department of Energy, Pittsburgh Energy Technology Center

Keynote Address: Magnetohydrodynamics - at the Crossroads

Joseph A. McElwain, Chairman

MHD Development Corporation.....

3

PLENARY SESSION INTERNATIONAL OVERVIEWS

Chairman: W. Steve Shepard
Mississippi State University

Australia

H.K. Messerle

University of Sydney.....

11

Finland

P.O. Kettune

Tampere University of Technology.....

21

France

A. Alemany

Institut de Mecanique de Grenoble

F. Werkoff

STT - Centre d'Etudes Nucleaires de Grenoble.....

29

India

V.K. Rohtagi, P.R. Dastidar, S.N. Seshadri

Bhabha Atomic Research Centre

S. Sridharan, V.R. Malghan, V. Balasubramanian

Bharat Heavy Electricals Ltd.....

39

Israel

H. Branover

Ben Gurion University of the Negev.....

44

***Italy**

F. Negrini

Instituto di Elettrotecnica, University of Bologna.....

61

Japan

S. Shiota

Tokyo Institute of Technology

Y. Aiyama

Electrotechnical Laboratory.....

62

The Netherlands

A. Veefkind, W.J.M. Balemans, P. Massee

University of Technology, Eindhoven.....

76

United States of America

S.W. Chun

US Department of Energy, Pittsburgh Energy Technology Center.....

89

*Papers were not available at time of publication.

International Liaison Group on MHD Electrical Power Generation (ILG-MHD)	
H.K. Messerle	
<i>University of Sydney, Australia</i>	
L.H. Th. Rietjens	
<i>University of Technology, Eindhoven, The Netherlands.....</i>	96

SESSION 1
COMBUSTION SYSTEMS, PART A
Chairman: J.W. Moyer, J.W. Moyer Associates
Vice Chairman: A. Solbes, TRW, Inc.

Development of IEEAS MHD Coal Combustors	
Ciwen Sha, Aihua Yang, Chengkang Dong, Guichun Zhang, Cufang Liang, Xuening Wui	
<i>Institute of Electrical Engineering, Academia Sinica, Beijing, China.....</i>	109
Combined Stage Performance Characterization of the 50 TRW MW(t) Coal-Fired Combustor	
R. Braswell, H. Iwata, L. Scinto, J. Steward	
<i>TRW, Inc.....</i>	116
Electrical Isolation and Continuous Removal of Slag from MHD Combustor Systems	
G. Roy	
<i>TRW, Inc.....</i>	126
Behaviour of Coal Particles on MHD Combustors - A Model	
S.A. Arunachalam, G.V.S. Rao	
<i>Bharat Heavy Electricals LTD., India</i>	
D.R. Iyer	
<i>Bhabha Atomic Research Centre, India.....</i>	134

SESSION 2
HIGH PERFORMANCE/INTERACTION GENERATORS
Chairman: R.L. Verga, DOD Strategic Defense Initiative Organization
Vice Chairman: S.T. Demetriades, STD Research Corporation

Initial Tests of a Lightweight, Self-Excited MHD Power Generator	
C.D. Maxwell, S.T. Demetriades	
<i>STD Research Corporation.....</i>	147
Experimental Study of Secondary Flow in an MHD Channel	
S.L. Girshick, C.H. Kruger	
<i>Stanford University.....</i>	159
Predicted Strength and Influence of MHD-Induced Secondary Flows in Recent Experiments	
C.D. Maxwell, D.W. Early, S.T. Demetriades	
<i>STD Research Corporation.....</i>	173
Devices With Strong MHD Interaction	
S.T. Demetriades, C.D. Maxwell	
<i>STD Research Corporation.....</i>	193

*Papers were not available at time of publication.

SESSION 3

MAGNETS, DIFFUSERS, AND DIAGNOSTICS

Chairman: R.A. Johnson, General Dynamics

Vice Chairman: P.G. Marston, MIT

A Survey of Magnet Experience Relevant to MHD

J.M. Tarrh, P.G. Marston

Massachusetts Institute of Technology..... 215

Conductor Development For Early Commercial Superconducting MHD Magnets

A.M. Dawson, A.M. Hatch, P.G. Marston, H. Becker, J.V. Minervini, J.M. Tarrh

Massachusetts Institute of Technology..... 234

MHD Diffuser Studies

J.J. Lee, Y.C.L. Wu, J.T. Lineberry

University of Tennessee Space Institute..... 252

Current Status of Optical Diagnostic Development in Support of Large-Scale MHD Test Facilities

R.L. Cook, W.S. Shepard, L.E. Bauman, E.J. Beiting, R.O. Daubach, J.D. Gassaway, L.R. Hester,

G.J. Hartwill, J.C. Luthe, W.W. Wilson, D.V. Srikantaiah, R.W. Strapp, R.D. Benton

MHD Energy Center, Mississippi State University..... 272

Non-Simultaneous Sampling Error in Modified Line Reversal Temperature Measurements

B.C. Winkelman, T.V. Giel, Jr.

University of Tennessee Space Institute..... 292

SESSION 4

GENERATORS, PART A

Chairman: M.F. Rose, Naval Surface Weapons Center

Vice Chairman: R.J. Rosa, Montana State University

Optimization of the Performance of Split-frame, Diagonal MHD Generators with Physical and Electromagnetic Constraints

G.R. Seikel

SeiTec, Inc.

C.D. Maxwell

STD Research Corporation..... 305

Performance Characteristic of Faraday Type MHD Generator With Shorted Electrode-Pair

(An Aspect of Inverter Test on ETL Mark VII Facility)

M. Ishikawa, K. Nomoto, J. Umoto

Kyoto University, Japan

Y. Kusaka

Electrotechnical Laboratory (ETL), Japan

T. Tanaka

Mitsubishi Electric Company, Japan..... 316

A One-Dimensional Arc Column Model and Its Effect on Boundary Layer Arc Behavior

R.J. Rosa

Montana State University

F.J. Fishman

Grand Rapids Junior College..... 331

*Investigation of Electrode Boundary Layers in Seeded MHD Plasmas

R.P. Dahiya, S.C. Sharma, A. Chand

Indian Institute of Technology, India..... 337

Projected Performance Characteristics for the Mark II MHD Generator of the IEE

Zixiang Ju

Institute of Electrical Engineering, Academia Sinica, Beijing, China

Y.C.L. Wu, J.T. Lineberry

University of Tennessee Space Institute..... 338

*Papers were not available at time of publication.

SESSION
5
GENERATORS, PART B

*Chairman: R.E. Rostenbach, National Science Foundation
Vice Chairman: C.H. Kruger, Stanford University*

Investigation of MHD Power Fluctuations

V.R. Malghan
Bharat Heavy Electricals, Ltd., India..... 361

The MHD Generator, An Integrated Design

A.R. Jones
Westinghouse Electric Corporation..... 371

Choice of Ceramic Fibre Insulation in Magnetohydrodynamics Systems

K. Thiagarajan
Bharat Heavy Electricals, Ltd., India..... 382

Cathode wall Nonuniformities in MHD Generators - Modeling and Comparison With Experiments

I. Sadovnik, C.C.P. Pian
Avco Everett Research Laboratory, Inc..... 392

Maximum Entropy Spectral Diagnosis of MHD Generator

Y. Aoki, T. Seidou, N. Kayukawa, H. Yamazaki, Y. Ozawa, H. Kitagawa
Hokkaido University, Japan..... 407

SESSION
6

CLOSED-CYCLE/DISK GENERATORS, PART A

*Chairman: W.E. Nixon, US Army Foreign Science and Technology Center
Vice Chairman: M. Petrick, Argonne National Lab*

***Parametric Evaluation of the Electric Field Breakdown Threshold in Combustion-Driven Disk MHD Generators**

W.E. Lear
University of Florida

T. Nakamura
Bechtel Group, Inc..... 429

Closed Cycle MHD Disk Experiments at the Tokyo Institute of Technology

H. Yamasaki, S. Kabashima, N. Harada, Y. Okuno, M. Watanabe, K. Yoshikawa, S. Shioda
Tokyo Institute of Technology, Japan..... 430

The Relation Between the Electrical Conductivity and the Current Density in an MHD Generator

P. Massee, J.C.W. Sars, W.F.H. Merck
University of Technology, Eindhoven, The Netherlands..... 439

Experimental Investigation of the Gasdynamic Interaction Between Streamers and Background Gas In A Noble Gas MHD Generator

J.C.N. Bosma, A. Veefkind, J.F. Uhlenbush, L.H. Th. Rietjens
University of Technology, Eindhoven, The Netherlands..... 450

Numerical Simulation of the Discharge Structure in Nonequilibrium Disk Type MHD Generator

Y. Inui, T. Hara, J. Umoto
Kyoto University, Japan..... 461

SESSION
7

COMBUSTION SYSTEMS, PART B

*Chairman: J.P. Strakey, US/DOE, Pittsburgh Energy Technology Center
Vice Chairman: H.F. Chambers, US/DOE, Pittsburgh Energy Technology Center*

Modeling of Dense Phase Coal Transport for MHD Applications

B.L. Liu, H.J. Schmidt
University of Tennessee Space Institute..... 479

*Papers were not available at time of publication.

An Analytical Model and the Calculation for the MHD Coal Combustor	
Zixiang Ju, Cuifang Liang, Bingmu Chen, Lixing Zhou	
<i>Institute of Electrical Engineering, Academia Sinica, Beijing, China.....</i>	491
Stirred Reactor Modeling for a Coal-Fired MHD System	
P.E. George, II, L.W. Crawford	
<i>University of Tennessee Space Institute.....</i>	503

SESSION 8
DOWNSTREAM COMPONENTS

<i>Chairman: M. Mulcahy, Boston Edison Co.</i>	
<i>Vice Chairman: J.C. Winslow, US/DOE, Pittsburgh Energy Technology Center</i>	
Chemical Kinetics of Nitric Oxide in the CFFF Furnace without a Slag Screen	
L.S.H. Chow, C.S. Wang, R.W. Lyczkowski	
<i>Argonne National Laboratory.....</i>	525
Gas-Side Fouling and Corrosion in MHD Combustion Systems	
M.K. White	
<i>University of Tennessee Space Institute</i>	
S.F. Chou, P.L. Daniel	
<i>Babcock & Wilcox Co.....</i>	541
A Parametric Study of Cold Side Electrostatic Precipitator Design Criteria for Coal Fired MHD Generators	
R.K. Morehead, J.P. Foote	
<i>University of Tennessee Space Institute.....</i>	555

SESSION 9
CLOSED-CYCLE/DISK GENERATORS, PART B

<i>Chairman: J.W Griswold, Southern California Edison Company</i>	
<i>Vice Chairman: W.R. Owens, Gilbert/Commonwealth, Inc.</i>	
*Testing of "ETGAR-3" Liquid Metal MHD Pilot Plant and Supporting Test Program at Ben Gurion University	
H. Branover, A. El-Boher, S. Lessin, Y. Unger, S. Sukoriansky	
<i>Ben Gurion University of the Negev</i>	
M. Petrick	
<i>Argonne National Laboratory.....</i>	575
On Self-Excitation and Separation Processes in Liquid Metal Converters	
R. Laborde, F. Joussellin	
<i>Institut de Mecanique de Grenoble, France.....</i>	576
Performance of Solar Thermal Systems With Liquid Metal MHD Conversion	
W.D. Jackson, E.S. Pierson	
<i>HMJ Corporation</i>	
M. Petrick, G. Berry, C. Dennis	
<i>Argonne National Laboratory.....</i>	587
Operating Characteristics of MHD Disk Generators	
H.K. Messerle, S.M. Marty, S.W. Simpson, F.J. Fishman	
<i>University of Sydney, Australia.....</i>	605
Instability and Fluctuation of Output Voltage of Disk Type Closed Cycle MHD Generator	
S. Kabashima, Y. Yoshikawa, Y. Okuno, H. Yamasaki, S. Shioda, E. Shimizu	
<i>Tokyo Institute of Technology, Japan.....</i>	624
The Magnetohydrodynamic Turbine Concept	
D.W. Lang	
<i>Australian Atomic Energy Commission Research Establishment, Australia.....</i>	636

*Papers were not available at time of publication.

SESSION 10
HEAT RECOVERY SEED RECOVERY/REGENERATION

*Chairman: F.E. Walter, The Montana Power Company
Vice Chairman: Y.C.L. Susan Wu, University of Tennessee Space Institute*

New Thermochemical Process for MHD Seed Regeneration

N. Takeuchi
National Chemical Laboratory for Industry, Japan..... 647

Thermodynamic Reactions of the Major Slag Species With Potassium Seed

G.A. Ducat, J.W. Moyer, J.D. Leeper
Southern California Edison Company
M. Farber, R.D. Srivastava
Space Sciences, Inc..... 656

Physicochemical Calculations Relevant to Seed Recovery and Generator Performance Studies

In MHD Power Generation

C.A. Luongo, C.H. Kruger
Stanford University..... 666

Thermal Radiation from Potassium Atoms in MHD Systems

C.S. Wang, L.S.H. Chow, E.B. Smyk
Argonne National Laboratory..... 686

A Predictive Phase Equilibrium Model for Multicomponent Oxide Mixtures Part III: MHD Slags

J.W. Hastie, E.R. Plante, D.W. Bonnell
National Bureau of Standards..... 701

Impact of Impurities on Plasma Conductivity and Available Options for Controlling Their Build-up

A.C. Sheth, L.W. Crawford, B.L. Liu
University of Tennessee Space Institute..... 718

SESSION 11
SPECIAL TOPICS

Chairman: M.A. Trykoski, Edison Electric Institute

Vice Chairman: A.R. Jones, Westinghouse Electric Corporation

***Optimal System Design and Fluctuation Analysis of Open Cycle MHD Power Generators**

R.P. Dahiya, Ami Chand
Indian Institute of Technology, India..... 737

Evaluation of Fuel Options for Indian Commercial MHD Plant

A.K. Das, V.K. Rohatgi, O.K. Subramanyam
Bhabha Atomic Research Centre, India..... 738

A Centralized MHD Data Base

J.H. Hirschenhofer
Gilbert/Commonwealth, Inc..... 746

Evaluation of SiC-Metal Bonding Elements Under Cruel Thermal Shock and High Heat Flux Conditions

T. Okuo, Y. Kusaka, Y. Aiyama, K. Takano, K. Kato, O. Nomura
Electrotechnical Laboratory, Japan..... 756

Application of MHD Process for Chlor-Alkali Industries

S. Sridharan, K.V.S. Sundaram
Bharat Heavy Electricals Limited, India..... 771

*Papers were not available at time of publication.

SESSION **(12)**
POWER CONDITIONING

*Chairman: A. Dolbec, Electric Power Research Institute
Vice Chairman: L. Angello, Electric Power Research Institute*

The Development of Consolidation Circuits Using Capacitive Energy Storage Elements

A. Lowenstein <i>Thermo Electron</i>	
E. Dinger <i>Consultant</i>	
R. Ritenour, R. Mulder, J. Felber <i>University of Virginia</i>	
J. Mandalakas <i>Mesta Electronics, Inc.</i>	779

MHD Consolidation Circuit Analysis

I. Sadovnik, V.J. Hruby <i>Avco Everett Research Laboratory, Inc.</i>	790
--	-----

Power Conditioning System for the CDIF

V.J. Hruby, R.M. Budny <i>Avco Everett Research Laboratory, Inc.</i>	
J. Mandalakas <i>Mesta Electronics, Inc.</i>	804

Fundamental Characteristics of MHD Generators Connected With Line-Commuted Inverter

N. Hayanose <i>Kobe Technical College, Japan</i>	
M. Ishikawa, J. Umoto <i>Kyoto University, Japan</i>	825

A Study of the Interaction of a Line-Commuted Inverter With a Full-Scale MHD Generator

S. Ramakrishnan, S. Matair, H.K. Messerle <i>University of Sydney, Australia</i>	839
---	-----

Preliminary Study on Control of Electrical Nonuniformities

M. Ishikawa, T. Sugiyama, K. Kishimoto, J. Umoto <i>Kyoto University, Japan</i>	854
--	-----

SESSION **(13)**
PROOF-OF-CONCEPT TESTING

*Chairman: B.R. Arora, Houston Lighting and Power Co.
Vice Chairman: J.M. Sherick, Mountain States Energy, Inc.*

Status of HRSR Component Installation and Testing at the Coal Fired Flow Facility

J. Foote <i>University of Tennessee Space Institute</i>	871
--	-----

Component Development and Integration Facility Test Program Status Report

L.C. Farrar, W.E. Lowry, A.T. Hart, A.L. Child <i>Mountain States Energy, Inc.</i>	879
---	-----

Testing of the TRW 50 MW(t) Coal-Fired Combustor at the Component Development and Integration Facility

G.J. Ogle <i>TRW, Inc.</i>	
W.E. Lowry <i>Mountain States Energy, Inc.</i>	888

*Papers were not available at time of publication.

CDIF 1A Channels Hardware Performance and Modifications	
R.J. Glovan, L.C. Farrar	
<i>Mountain States Energy, Inc.</i>	900
Faraday and Diagonal Channel Performance	
L.C. Farrar	
<i>Mountain States Energy, Inc.</i>	910
Panel Discussion:	
Chairman: Dr. Heinz G. Pfeiffer, Manager	
<i>Technology and Energy Assessment, Pennsylvania Power and Light Company</i>	
Authors Index	925