

INTERFACIAL WAVE GENERATION IN EXPLOSIVE WELDING OF MULTILAMINATES: S. A. L. Salem and S. T. S. Al-Hassani; Dept. of Mechanical Engineering, UMIST, Manchester, U.K.

FRACTURING OF EMBRITTLED STEEL VESSELS INTO PREFORMED FRAGMENTS BY IMPULSIVE LOADING: Hans-Ulrich Freund, Reinhard Synofzik, Battelle-Institut e.V., Frankfurt am Main

THE PRODUCTION OF STRONG PARTS AND NON-EQUILIBRIUM ALLOYS BY DYNAMIC COMPACTION: Derek Raybould; Institut CERAC S.A., Ecublens, Switzerland.

5:40-6:00
Panel Discussion

ALBUQUERQUE AND CENTRAL NEW MEXICO CLIMATE

The average maximum and minimum daily temperatures during the period of the conference will be approximately 38°C (100°F) and 18°C (65°F), respectively, and the climate will be semi-arid. The humidity will be low and there will be calm breezes especially in the late afternoon. Solar radiation will be optimum and there will be there little air pollution. Albuquerque is approximately 1 mile above sea level. Thundershowers can occur in the late afternoon during this period, but chances for rain are rare.

CONFERENCE REGISTRATION

The advance registration fee (prior to June 1, 1980) is \$100. Registration after June 1 and at the meeting will be \$120.00. Please make registration fee payable to EXPLOMET-NEW MEXICO TECH; only checks or money orders will be accepted (no purchase orders please). Persons cancelling registration will receive one copy of the conference proceedings. In view of our financial commitments no refunds can be made. Registration fee includes:

- *Cocktail party at opening session
- *Formal conference banquet
- *Transportation to special program at New Mexico Tech
- *Barbeque at New Mexico Tech including wine and beer mixer
- *One hard-bound copy of conference proceedings (to be published and distributed by Plenum Publishing Corp. on or before January 1981).

A special program for ladies and accompanying family members will be organized. Cost for lunches or other fees including transportation will be described in a special program mailing. If you will bring your wife or other guests please indicate below. We will send the pro-

gram prior to the conference. Ladies and family members will not need to register. Please send your registration form and check (or money order) to:

EXPLOMET
Dept. of Met. and Mat. Eng.
New Mexico Tech
Socorro, New Mexico 87801
USA

HOTEL RESERVATIONS

Please use the enclosed envelope and return your reservation *directly* to the hotel (Albuquerque Inn; P.O. Box 1927; Albuquerque, New Mexico 87103 USA).



INTERNATIONAL CONFERENCE ON THE METALLURGICAL EFFECTS OF HIGH STRAIN-RATE DEFORMATION AND FABRICATION

Albuquerque Inn
Albuquerque, New Mexico, U.S.A.
June 22-26, 1980

PROGRAM

Conference Chairmen

Marc A. Meyers

Lawrence E. Murr

Department of Metallurgical and Materials Engineering
New Mexico Institute of Mining and Technology
Socorro, New Mexico 87801 USA
Tel: (505) 835-5831

Sponsored by:

- *U.S. ARMY RESEARCH OFFICE (METALLURGY AND MATERIALS SCIENCE DIVISION)
- *NATIONAL SCIENCE FOUNDATION (DIVISION OF MATERIALS RESEARCH)
- *NEW MEXICO TECH RESEARCH AND DEVELOPMENT DIVISION
- *NEW MEXICO TECH RESEARCH FOUNDATION
- *PHYSICAL AND MECHANICAL METALLURGY COMMITTEES OF THE METALLURGY SOCIETY OF AIME (American Institute of Mining, Metallurgical, and Petroleum Engineers)

The scientific understanding of high-velocity deformation has advanced substantially in the past years. On the one hand, the framework of a theory explaining the metallurgical effects of shock waves is beginning to take shape; on the other hand, the technological applications of high strain-rate processes have found their way into industry. Explosive welding, cladding, forming, compaction, cutting, and hardening, in addition to high energy-rate deformation processes using other energy sources are some of the topics of contemporary technological importance. Metallurgical effects are of utmost importance in both the scientific understanding of the phenomena involved and in the successful development and utilization of the applications.

This conference has as its major objectives the acceleration of progress in the field by providing a forum for the interaction and exchange of state-of-the-art information on the metallurgical effects of high strain-rate deformation and fabrication, and the organization of this information into a coherent body of knowledge focused around significant areas and applications.

SUNDAY, JUNE 22 7:00-10:00 p.m.

7:00-8:00
Evening Cocktail

8:00-8:10
Opening Address: L. E. Murr

8:10-9:00
Keynote Presentation:

HISTORICAL PERSPECTIVE OF THE FIELD: John S. Rinehart; HyperDynamics, Inc. PO Box 392, Santa Fe, New Mexico 87501

9:00-10:00
Open Bar (Cash Bar)

MONDAY, JUNE 23 8:30-12:00 a.m.

HIGH STRAIN-RATE DEFORMATION, Chairman: G. Mayer, U.S. Army Research Office

8:30-9:10
Invited Presentation:

MATERIALS RESPONSE UNDER IMPULSIVE LOADING: John W. Taylor and Siegfried S. Hecker; Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545

9:10-11:40
Contributed Presentations:

COMPARISONS OF FLOW CURVES FOR 6061 ALUMINUM ALLOY AT HIGH AND LOW STRAIN RATES: A. E. Carden, P. E. Williams, and R. R. Karpp; Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545

MECHANICAL PROPERTIES AT HIGH STRAIN RATE UNDER BIAXIAL LOADING FOR AUSTENITIC STAINLESS STEEL: C. Albertini, M. Montagnani; Commission of the European Communities, Joint Research Centre, Ispra Establishment, I-21020 Ispra (Va) Italy

DYNAMIC BEHAVIOR OF HIGH STRENGTH STEELS UNDER TENSION: Lothar W. Meyer, Hans-Dieter Kunze and Klaus Seifert; Institut für angewandte Materialforschung, Lesumer Heerstr. 36, D-2820 Bremen 77, West Germany

AN IMPROVED TECHNIQUE FOR DETERMINING DYNAMIC MATERIAL PROPERTIES USING THE EXPANDING RING: R. H. Warnes, T. A. Duffey, R. R. Karpp, and A. E. Carden; Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545

PLASTIC DEFORMATION OF COLLIDING HEMI-SHELLS: David C. Moir; Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545

DEFORMATION MECHANISMS OF IMPACT-LOADED TUNGSTEN SINTER MATERIALS: Reinhard H. Tham, Alois J. Stilp; Ernst-Mach-Institut, 7800 Freiburg, FRG

EFFECTS OF STRAIN RATE ON DEFORMATION-INDUCED MARTENSITE IN 304 STAINLESS STEEL: K. P. Staudhammer*, C. E. Frantz*, S. S. Hecker* and L. E. Murr**; *Los Alamos Scientific Laboratory, Los Alamos, N.M. 87545; **New Mexico Institute of Mining and Technology, Socorro, N.M. 87801

SOME METALLURGICAL ASPECTS OF THE DYNAMIC EXPANSION OF SHELLS: M. Stelly and J. Legrand; C.E.A.—Service de Metallurgie—MS BP No. 511-75-752, Paris Cedex 15, France

11:40-12:10
Panel Discussion

MONDAY, JUNE 23 2:00-5:00 p.m.

DYNAMIC FRACTURE, Chairman: S. T. S. Al-Hassani, U. of Manchester Institute of Technology

2:00-2:40
Invited Presentation:

LINKING DYNAMIC FRACTURE TO MICROSTRUCTURAL PROCESSES: D. R. Curran; Department of Shock Physics and Geophysics, SRI International, Menlo Park, California 90425

2:40-4:30
Contributed Presentations:

INTERNAL FRACTURE GENERATION IN SOLIDS OF REVOLUTION BY STRESS WAVE FOCUSING: S. T. S. Al-Hassani; Dept. of Mechanical Engineering, UMIST Manchester, U.K., and J. F. Silva Gomes; Faculdade de Engenharia, Universidade do Porto, Portugal

APPLICATION OF SURVIVAL STATISTICS TO THE IMPULSIVE FRAGMENTATION OF DUCTILE RINGS: Dennis E. Grady; Geomechanics Division 5532, Sandia Laboratories, Albuquerque, New Mexico 87185

THE EFFECT OF STRAIN HISTORY ON CRACK INITIATION UNDER DYNAMIC LOADING: N-G Ohlson; Royal Institute of Technology, Dept. of Solid Mechanics, S-100 44 Stockholm, Sweden

CONTROL OF POROSITY AND SPALL FAILURE IN SHOCK LOADED ALUMINUM ALLOY: Victor A. Greenhut, Ming-Guang Chen, and Sigmund Weissmann; College of Engineering, Rutgers University, Piscataway, New Jersey 08854

4:20-5:00
Panel Discussion

6:30
Cocktails in Albuquerque Inn (Cash Bar)

7:15
Formal Dinner (Albuquerque Inn)

TUESDAY, JUNE 24 8:30-11:30 a.m.

APPLICATIONS: DYNAMIC COMPACTION OF POWDERS, Chairman: Vonne D. Linse, Battelle Columbus Laboratories

8:30-9:10
Invited Presentation:

FUNDAMENTALS OF EXPLOSIVE COMPACTION OF POWDERS: Oleg V. Roman and Valery G. Gorobtsov; Powder Metallurgy Research Institute, Minsk 220600, U.S.S.R.

9:10-11:10
Contributed Presentations

ON FORMATION MECHANISM OF METALLURGICAL INHOMOGENEITIES OF ACCOMPANYING SHOCK COMPACTION OF POROUS METALS: Nikolaj A. Kostjukov; Institute of Hydrodynamics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk, 630090, U.S.S.R.

RESPONSE OF METAL POWDERS TO HIGH TRANSIENT ELECTRICAL DISCHARGE: S. T. S. Al-Hassani; Dept. of Mechanical Engineering, UMIST, Manchester, U.K.

METALLURGICAL EFFECTS UNDER SHOCK COMPRESSION OF POWDER MATERIALS: Anatoly M. Staver; Institute of Hydrodynamics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk, 630090, U.S.S.R.

OBSERVATION OF DISLOCATIONS AND TWINS IN EXPLOSIVELY COMPACTED ALUMINA: C. S. Yust and L. A. Harris; Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830

11:00-11:30
Panel Discussion

TUESDAY, JUNE 24 11:30-12:10; 2:00-3:30

ADIABATIC SHEARING, Chairman: R. N. Orava, South Dakota School of Mines and Technology

Contributed Presentations:

METALLURGICAL INFLUENCES ON SHEAR BAND ACTIVITY: D. A. Shockey and D. C. Erlich; Department of Shock Physics and Geophysics, SRI International, Menlo Park, California 94025

FORMATION OF ADIABATIC SHEAR BANDS DURING UPSETTING OF 18-4-1 ALLOY STEEL AT HIGH STRAIN RATES: S. M. Doraivelu, V. Gopinathan and V. C. Venkatesh; Metal Forming Laboratory, Indian Institute of Technology, Madras 600 036, India

A CRITERION FOR THERMO-PLASTIC SHEAR INSTABILITY: Y. L. Bai; Institute of Mechanics, Chinese Academy, Peking, China

A STUDY OF THE MATERIAL FAILURE MECHANISMS IN THE SHEAR-CONTROL PROCESS: John Pearson and Stephen A. Finnegan; Michelson Laboratories, Naval Weapons Center, China Lake, California 93555

MATERIAL FACTORS IN ADIABATIC SHEARING: Harry C. Rogers and C. V. Shastri; Department of Materials Engineering, Drexel University, Philadelphia, Pennsylvania 19104

SHEAR STRAINS, STRAIN RATES AND HEATING IN ADIABATIC SHEAR BANDS IN A Ni-Cr STEEL: Gerald L. Moss; Solid Mechanics Branch, TBD, Ballistic Research Laboratory, Aberdeen Proving Ground, Maryland 21005

DESCRIPTION OF "HOT SPOTS" ASSOCIATED WITH LOCALIZED SHEAR ZONES IN IMPACT TESTS: C. S. Coffey; Naval Surface Weapons Center, Silver Spring, MD; R. W. Armstrong; University of Maryland

TUESDAY JUNE 24 3:30-6:00 p.m.

SHOCK WAVES I: EXPERIMENTAL TECHNIQUES, Chairman: K. P. Staudhammer, Los Alamos Scientific Laboratory

3:30-4:50

Invited Presentations:

DEFECTS IN SHOCK-LOADED SOLIDS AS INDICATED BY ELECTRICAL RESPONSE MEASUREMENTS: R. A. Graham; Sandia National Laboratories, Albuquerque, New Mexico 87185

HOW TO DESIGN AND INSTRUMENT A SYSTEM FOR THE PRODUCTION OF PLANAR SHOCK WAVES: Paul de Carli; Shock Physics and Geophysics, SRI International, Menlo Park, California 94025; Marc A. Meyers; Dept. of Metallurgical and Materials Engineering, New Mexico Tech, Socorro, NM 87801

4:50-6:00

Contributed Presentations:

DETERMINATION OF PRESSURE IN A METAL PLATE AT PROPAGATION OF LOADING OVER THE PLATE SURFACE: V. V. Pai, V. A. Simonov; Institute of Hydrodynamics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk, 630090, U.S.S.R.

DYNAMIC PRESSURE-SHEAR LOADING OF MATERIALS USING ANISOTROPIC CRYSTALS: L. S. Chhabildas and J. W. Swegle; Sandia National Laboratories, Albuquerque, New Mexico 87185

DETERMINATION OF THE SHEAR STRENGTH OF SHOCK COMPRESSED 6061-T6 ALUMINUM: J. R. Asay and L. C. Chhabildas; Sandia National Laboratories, Albuquerque, New Mexico 87185

ATTENUATION OF SHOCK WAVES IN NICKEL: K. C. Hsu, C. Y. Hsu, and M. A. Meyers; Dept. of Metallurgical and Materials Engineering, New Mexico Institute of Mining and Technology, Socorro, NM 87801

WEDNESDAY, JUNE 25 8:30-12:30

SHOCK WAVES II: FUNDAMENTALS, Chairman: R. W. Rohde, Sandia National Laboratories

8:30-9:10

Invited Presentation:

HIGH-SPEED DISLOCATIONS: J. Weertman; Northwestern University

9:10-10:20

Contributed Presentations:

DISLOCATION DRAG MECHANISMS, HIGH VELOCITY DISLOCATIONS AND TWINNING: J. M. Galligan; Department of Metallurgy and Institute of Materials Science, University of Connecticut, Storrs, CT 06268

ULTRASONIC DETECTION OF THE BEHAVIOR OF DISLOCATIONS AT HIGH RATES OF STRAIN: Jumpei Shioiri and Katsuhiko Satoh; Department of Aeronautics, Faculty of Engineering, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan

GENERATION OF A PRESSURE PULSE FOR DISLOCATION VELOCITY STUDIES: T. Vreeland, Jr., B. Wielke, and D. S. Wood; Division of Engineering and Applied Science, California Institute of Technology, Pasadena, Calif. 91125

10:20-10:50

Invited Presentation:

DEFECT GENERATION IN SHOCK-WAVE DEFORMATION: Marc A. Meyers and Lawrence E. Murr; Department of Metallurgical and Materials Engineering, New Mexico Institute of Mining and Technology, Socorro, NM 87801

10:50-12:30

Contributed Presentations:

MECHANISMS OF DEFORMATION UNDER SHOCK LOADING: Mikhail A. Mogilevsky; Institute of Hydrodynamics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk 630090, U.S.S.R.

COMPUTER MODELLING OF DEFECT FORMATION UNDER SHOCK LOADING: Mikhail A. Mogilevsky; Institute of Hydrodynamics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk 630090, U.S.S.R.

REGISTRATION FORM — EXPLOMET 1980

NAME (as you wish it to appear on your badge): _____

ORGANIZATION: _____

MAILING ADDRESS: _____

Street

City

State

Zip

I am bringing additional members of my family that want to take part in the family program _____

YES

NO

Additional tickets: _____

Formal Dinner at \$15.00 each _____

Special Program and Barbeque at \$15.00 each _____

Total enclosed (including registration fee) _____

DISLOCATION GENERATION IN PURE ALUMINUM: Torbjörn Svensson; National Defense Research Institute, FOA 232, Fack, S-10450 Stockholm, Sweden

THOMAS-FERMI APPROXIMATION FOR SHOCK-WAVE STRUCTURE IN METALS: V. F. Nesterenko; Special Construction Bureau, Siberian Division of the USSR Academy of Sciences, Novosibirsk-90, U.S.S.R.

RESPONSE OF MAR-M200 (A NICKEL BASE SUPER-ALLOY) TO SHOCK LOADING AT ROOM TEMPERATURE: Dattatraya P. Dandekar; US Army Materials and Mechanics Research Center, Watertown, Massachusetts 02172

WEDNESDAY, JUNE 25 2:00-10:00 p.m.

FIELD TRIP TO NEW MEXICO TECH AND BARBEQUE

2:00

Buses leave hotel

3:30-5:30

Visit to TERA (Terminal Effects Research and Analysis Group), New Mexico Tech Research and Development Division

5:30-6:30

Beer and Wine Mixer

6:30-8:30

Barbeque; New Mexico Tech Golf Course Picnic Area

8:30-10:00

Buses return to Albuquerque Inn

THURSDAY, JUNE 26 8:30-12:10

SHOCK WAVES III: MICROSTRUCTURAL AND MECHANICAL EFFECTS, Chairman: C. Stein, Air Force Weapons Laboratory and New Mexico Institute of Mining and Technology

8:30-9:10

Invited Presentation:

EFFECTS OF LASER-INDUCED SHOCK WAVES IN METALS: A. H. Clauer; Batelle, Columbus, Ohio, and B. P. Fairand, Laser Consultant

9:10-11:40

Contributed Presentations:

SHOCK-INDUCED MARTENSITE REVERSAL IN Fe/30%Ni: George E. Duvall and Paul M. Bellamy; Department of Physics, and Ronald J. Livak; Department of Materials Science and Engineering, Washington State University, Pullman, Washington 99164

SHORT DURATION SHOCK PULSES AS A TOOL TO STUDY THE TIME DEPENDENCE OF PLASTIC DEFORMATION: R. N. Wright, S. LaRouche and D. E. Mikola; Department of Metallurgical Engineering, Michigan Technological University, Houghton, Michigan 49931

METALLURGICAL EFFECTS ON IMPACT LOADED MATERIALS: Hans Dieter Kunze and Karl Heinz Hartman; Fraunhofer-Institut für angewandte Materialforschung, Bremen, W. Germany

THE EFFECTS OF PEAK PRESSURE, PULSE DURATION, AND REPEATED SHOCK LOADING ON THE RESIDUAL STRUCTURE AND PROPERTIES OF METALS AND ALLOYS: L. E. Murr; Department of Metallurgical and Materials Engineering, New Mexico Institute of Mining and Technology, Socorro, New Mexico 87801

MAGNETIC PROPERTIES AND MICROSTRUCTURES ASSOCIATED WITH THE SHOCK INDUCED TRANSFORMATION OF fcc IRON TO bcc IRON: Peter Wasilewski; Laboratory for Extraterrestrial Physics, Goddard Space Flight Center, Greenbelt, MD 20771

INVESTIGATION OF RESIDUAL CHANGE STABILITY IN STRUCTURE AND PROPERTIES OF INTERNALLY OXIDIZED ALLOYS $\text{Cu-Al}_2\text{O}_3$ AFTER LOADING BY PLANE SHOCK WAVES: M. P. Bondar, V. A. Simonov; Institute of Hydrodynamics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk, 630090, U.S.S.R.

11:40-12:10

Panel Discussion

THURSDAY, JUNE 26 2:00-6:00

APPLICATIONS: GENERAL, Chairman, A. A. Ezra, National Science Foundation

2:00-3:20

Invited Presentations:

EXPLOSIVE METAL WORKING IN THE U.S.S.R.: Audrey A. Deribas; Special Construction Bureau, Siberian Division of the U.S.S.R. Academy of Sciences, Novosibirsk-90, U.S.S.R.

EXPLOSIVE WELDING—A REVIEW: S. H. Carpenter; U. of Denver, Denver, Colorado

3:20-5:40

Contributed Presentations:

METALLURGICAL ASPECTS OF THE PERFORATION OF SINGLE AND LAMINATED PLATE SHIELDS BY A HIGH SPEED PROJECTILE: Adnan I. O. Zaid; P.O. Box 745, University of Technology, Tell O. Mohammed, Baghdad, Iraq

MICROSTRUCTURE AND BONDING MECHANISM IN EXPLOSIVE WELDING: Michael Hammerschmidt and Heinrich Kreye, Institut für Werkstofftechnik, Hochschule der Bundeswehr, 2000 Hamburg 70, F.R. Germany

INFLUENCE OF COLLISION PARAMETERS ON THE MORPHOLOGY OF INTERFACE IN ALUMINUM-STEEL EXPLOSION WELDS: H. K. Balakrishna*, V. C. Venkatesh and P. K. Phillip@. *U.V.C.E., Bangalore -1. @I.I.T. Madras -36, India

RECRYSTALLIZATION OF EXPLOSIVELY FORMED SHEET METAL PARTS OUT OF BRASS AND ALUMINUM: Abdel-Aziz Hegasy; Faculty of Engineering and Technology, Helwan, Egypt