

CONTENTS OF VOLUME 2

Preface	xvii
6th AIRAPT Conference Planning Committee	xxi
International Advisory Committee	xxi
Corresponding Members of International Advisory Committee .	xxii
Acknowledgments	xxii

I. HIGH PRESSURE GEOPHYSICAL/GEOLOGICAL APPLICATIONS

A. Stability and Structures of Mantle Materials

A-1 Geophysical Applications of High Pressure Research, W. A. BASSETT, Cornell University	1
A-2 High-Pressure Transformations of Dioxides With the Rutile Structure, L.-G. LIU, California Institute of Technology	17
A-3 The Post-Ilmenite Phases of Silicates, Germanates, and Titanates: A Review, E. ITO and Y. MATSUI, Okayama University	24
A-4 Kinetics of the Olivine \rightarrow Spinel Transition Under High Pressure and Temperature: Experimental Results and Geophysical Implications, C-M. SUNG, Massachusetts Institute of Technology and General Electric Company .	31
A-5 Polymorphic Transformations in the Earth's Mantle Structure of the Phase Boundary, J. LELIWA-KOPYSTYŃSKI, Polish Academy of Science, and A. LACAM and J. PEYRONNEAU, Universités de Paris	43
A-6 Studies of Phase Equilibrium in Mg_2SiO_4 up to Pressures Higher Than 20 GPa, K. SUITO and N. KAWAI, Osaka Uni- versity	53

B. Properties of Mantle Materials

B-1	Identification of Radiative Thermal Conductivity of Olivine up to 25 kbar and 1500 K, G. H. SCHÄRMELI, Universität München	60
B-2	Elastic Properties Measured Under Hydrostatic Pressure in the Diamond-Anvil Cell by X-ray Diffraction and Brillouin Scattering, W. A. BASSETT, D. R. WILBURN, J. A. HRUBEC and E. M. BRODY, University of Rochester .	75
B-3	A Technique for Measuring the Single Crystal Elastic Properties of High Pressure Phases, D. J. WEIDNER and M. T. VAUGHAN, State University of New York at Stony Brook	85
B-4	Hydrostatic Compression of Perovskite Phase of SrGeO_3 , Y. SATO, University of California at Los Angeles, and S. AKIMOTO, The University of Tokyo	91
B-5	Elasticity of Stishovite Revisited, D. H. CHUNG, Lawrence Livermore Laboratory, University of California	97
B-6	Sound Velocity on SiO_2 , Hugoniots, J. A. MORGAN and J. N. FRITZ, Los Alamos Scientific Laboratory, University of California	109
B-7	Grüneisen Parameter of Fluids and Metals Under Compression, R. BOEHLER, J. RAMAKRISHNAN and G. C. KENNEDY, University of California at Los Angeles	119
B-8	Macroscopic and Microscopic Grüneisen Parameters of Garnet, Olivine and Pyroxene, P. DIETRICH and J. ARNDT, University of Tübingen	125

C. Properties of Crystal Silicates and Melts

C-1	The Pressure-Temperature Stability Field of Barium Titanate Under Constraint, G. W. TIMCO and H. H. SCHLOESSIN, University of Western Ontario	127
C-2	Chemically Reacting SiO_2 , H_2O , and $\text{SiO}_2 + \text{H}_2\text{O}$ Systems Under High Pressure and Temperature, F. H. REE, Lawrence Livermore Laboratory, University of California	135
C-3	Crystal Chemistry and Stability of a High-Pressure Hydrous 10Å Layer Silicate in the System $\text{MgO}-\text{SiO}_2-\text{H}_2\text{O}$, J. F. BAUER and C. B. SCLAR, Lehigh University	144
C-4	The Solubility of Water in Alkali-Alumino-Silicate Melts to 8 kbars, S. OXTOBY and D. L. HAMILTON, Manchester University	153

C-5	Production of Alkaline Rocks by the Alteration of Haplogranites and Haplobasalts Under High Pressures and Temperatures, N. V. KOTOV, N. F. SHINKAREV, M. O. DOMNINA, A. V. DONSKIH and M. P. ROGOSIN, Leningrad State University	159
D. Properties of Alkali Halides		
D-1	The Use of the Isotropic Sodium Chloride Acoustic Velocity Ratio in Ultra High Pressure Physics, J. FRANKEL, F. J. RICH, C. G. HOMAN, M. A. HUSSAIN and R. D. SCANLON, U.S. Army Benet Weapons Laboratory, Watervliet Arsenal	175
D-2	A Test of the NaCl Equation of State by the Behavior of the Shear Velocities at High Pressure, O. L. ANDERSON and J. MAMMONE, University of California, Los Angeles	181
D-3	The Dependence on the Equation of State of NaCl Upon the Choice of the Intermolecular Potential Function, F. MULARGIA, University of California, Los Angeles	195
E. Properties of Glasses and Rocks		
E-1	Equation of State for Metasilicate Glasses, N. SOGA, H. YAMANAKA and M. KUNUGI, Kyoto University	200
E-2	Effect of High Temperature and High Confining Pressure on Compressional Wave Velocities in Rocks, H. KERN, Institut der Universität Kiel	207
E-3	Pressure Dependence of Elastic Properties for $B_2O_3-Na_2O$ Glasses and Equations of State for Glass, R. OTA, H. YAMANAKA and M. KUNUGI, Kyoto University ...	209
E-4	Compressional and Shear Wave Velocities of Volcanic Rocks and Glasses to 900°C at 20 kbar, S. MATSUSHIMA, Kyoto University	216
F. Lower Mantle and Core Geophysics		
F-1	Theoretical Equations of State of Iron at the Earth's Core Conditions, E. BOSCHI and D. FAZIO, Università di Bologna, and F. MULARGIA, University of California, Los Angeles	223
F-2	On the Character of Convective Motions in the Earth's Mantle, V. A. ALEKSEEV and A. V. GETLING, Research Institute of Nuclear Physics, M. V. LOMONOSOV, Moscow State University	231

F-3	Compressed Potassium: A Siderophile Element, M. S. T. BUKOWINSKI, University of California, Los Angeles	237
F-4	Physicochemical Model of the Formation of the Earth's Core, O. L. KUSKOV and N. I. KHITAROV, Vernadsky Institute of Geochemistry and Analytical Chemistry	245

G. Rock Mechanics

G-1	Q Measurements Under Confining Pressure, B. R. TITTMANN, H. NADLER, L. AHLBERG and E. R. COHEN, Rockwell International	255
G-2	Reproducibility of Remanent Magnetization Changes and Volumetric Strain With Multiple Stress Cycles, R. E. HABERMANN and R. J. MARTIN III, University of Colorado/NOAA	263
G-3	Multiaxial Testing to Determine Material Behavior for Design of Energy Related Structures, S. STURE, Virginia Polytechnic Institute and State University, and R. H. ATKINSON and H.-Y. KO, University of Colorado	272
G-4	Stress Wave Propagation in Rock, D. E. GRADY, Sandia Laboratories	282
G-5	Contrasting Fracture Models for Granite Under Dynamic Loading, L. A. GLENN and W. JANACH, Institut CERAC	290
G-6	An Empirical Relation for Dilatant Behavior in Brittle Rocks, M. S. CONSTANTINO and R. N. SCHOCK, Lawrence Livermore Laboratory, University of California	291
G-7	Oil Shales Under Dynamic Stress, B. OLINGER, Los Alamos Scientific Laboratory, University of California	303
G-8	Hugoniots of Colorado Oil Shale, W. J. CARTER, Los Alamos Scientific Laboratory, University of California.	317

II. HIGH PRESSURE IN ENERGY RESOURCE RECOVERY

H. Energy Resource Recovery

H-1	Mechanics of High Pressure Rock Deformation as Related to Oil and Gas Recovery, S. J. GREEN and A. H. JONES, Terra Tek	324
H-2	Microstructure of Laboratory and Nuclear Explosively Deformed Gas-Bearing Sandstones, L. A. DENGLER, Lawrence Livermore Laboratory, University of California	335

H-3	Use of Heavy-Oil Recycle to Reduce Operating Pressure for Non-Fouling Operation in Thermal Hydrocracking, C. P. KHULBE, B. B. PRUDEN and J. M. DENIS, Canada Centre for Mineral and Energy Technology	346
H-4	High-Pressure Water Jet Applications in Drilling Operations, T. J. LABUS, IIT Research Institute	356
H-5	Some New Concepts Relating to the Initiation and Failure of Detonable Explosives, D. J. PASTINE, D. J. EDWARDS, H. D. JONES, C. T. RICHMOND and K. KIM, Naval Surface Weapons Center	364

J. Coal Gasification

J-1	Status of Coal Gasification: 1977, F. C. SCHORA and W. G. BAIR, Institute of Gas Technology	383
J-2	Coal Gasification in Europe, D. SEELEMANN, Centre d'Etudes et Recherches des Charbonnages de France	388

K. Underground Explosions

K-1	Change in the Permeability of a Medium in the Inelastic Deformation Zone During an Underground Explosion, V. N. RODIONOV, A. A. SPIVAK and V. M. TSVETKOV, Institute of Earth Physics	397
K-2	Explosive Enhancement of Permeability, M. HANSON, C. MC KEE and R. TERHUNE, Lawrence Livermore Laboratory, University of California	407
K-3	Calculation of Oil Shale Fractures Generated by a Column of Explosive in a Borehole, M. E. KIPP, Sandia Laboratories	426

L. Material Modeling

L-1	Computer Simulations of High Pressure Systems, M. L. WILKINS, Lawrence Livermore Laboratory, University of California	433
L-2	Analytical Failure Surfaces for Oil Shales of Varying Kerogen Content, J. N. JOHNSON, Los Alamos Scientific Laboratory, University of California, and E. R. SIMONSON, Terra Tek, Inc.	444
L-3	Current Topics in Non-Elastic Deformation of Geological Materials, V. N. NIKOLAEVSKII, Institute of Physics of the Earth, and J. R. RICE, Brown University	455

L-4	Computer Simulation of Fracture in Small Scale Borehole Experiments in Oil Shale, W. J. MURRI, D. R. CURRAN, D. A. SHOCKEY, L. SEAMAN, R. E. TOKHEIM, S. L. MC HUGH and C. YOUNG, SRI International	465
L-5	A Computational Model for Explosive Fracture of Oil Shale, D. A. SHOCKEY, W. J. MURRI, R. E. TOKHEIM, C. YOUNG, S. L. MC HUGH, L. SEAMAN and D. R. CURRAN, SRI International	473

III. MECHANICAL PROPERTIES AT HIGH PRESSURES

M. Plastic Deformation at High Pressure

M-1	Mechanical Behavior of Solids at High Pressure, H. LL. D. PUGH, Rolls Royce, Ltd.	483
M-2	Shear Deformation Under Hydrostatic Pressure of Polytetrafluoroethylene and Polycarbonate, K. D. PAE and J. A. SAUER, Rutgers University, and A. A. SILANO, Kean College	512
M-3	Plastic Deformation Behavior of a Brittle Material Under High Pressure and High Temperature, A. OGUCHI, M. NOBUKI, Y. KAIEDA and M. OTAGUCHI, National Research Institute for Metals	519

N. Mechanical Properties of Ultra-Hard Materials

N-1	The Fracture and Yield Strengths of Diamond, Silicon and Germanium, A. L. RUOFF, Cornell University	525
N-2	Impact Resistance of Single Crystal and Polycrystalline Man-Made Diamonds, S. MUSIKANT, R. J. SULLIVAN and K. J. HALL, General Electric Company	549
N-3	Effect of Pressures up to 2.0 GPa on the Mechanical Properties of Tungsten Carbide, P. A. BREW and B. CROSSLAND, The Queen's University of Belfast	559
N-4	Hypervelocity Impact Phenomena: Unique Experimental and Modeling Techniques, M. E. GRAHAM, Effects Technology, Inc.	567
N-5	Fatigue Strength of Cemented Tungsten Carbides and Tool Steels Subjected to Cyclic Compressive Stresses, J. ROGAN, Imperial College, University of London, and J. S. C. PARRY, University of Bristol	577

N-6	Fatigue Strength of Tool Steels T1, M2 and M42 Subjected to High Compressive-Low Tensile Stress Cycling, J. ROGAN, Imperial College, University of London	583
 O. Design, Analysis and Monitoring of High Pressure Vessels		
O-1	Design of Large Monobloc High-Pressure Vessels, D. E. WITKIN, National Forge Company	589
O-2	Wire Wound High Pressure Vessels for Industrial Applications, T. JOHANNISSON and K. ZANDER, ASEA AB ...	601
O-3	A Review of the Fatigue and Fracture of Thick-Walled Pressure Vessels, B. CROSSLAND, The Queen's University of Belfast	607
O-4	Detection and Monitoring of Defects in Pressure Vessels, A. R. WHITING, Southwest Research Institute ..	613
O-5	Development of an Ultrasonic Imaging System for Inspection of Nuclear Reactor Pressure Vessels, F. L. BECKER, V. L. CROW, J. C. CROWE, T. J. DAVIS, B. P. HILDEBRAND and G. J. POSAKONY, Battelle-Northwest	621

IV. INDUSTRIAL APPLICATIONS OF HIGH PRESSURE

P. Hot Isostatic Processing: Process and Equipment

P-1	Hot Isostatic Processing, H. D. HANES, Battelle Columbus Laboratories	633
P-2	Hot Isostatic Pressing of Shaped Silicon Nitride Parts, H. LARKER, ASEA AB	651
P-3	Application of Hot Isostatic Pressing to Aircraft Gas Turbines, D. J. EVANS, Pratt and Whitney Aircraft	656
P-4	Development and Operation of a Large Hot Isostatic Pressing System, C. B. BOYER, D. S. WOESSNER and T. C. RHODES, Battelle Columbus Laboratories	664
P-5	HIP Equipment for Industrial Applications, F. X. ZIMMERMAN, Autoclave Engineers, Inc.	679
P-6	Hot Isostatic Pressing, A. G. BOWLES and D. E. WITKIN, National Forge Company	686

Q. Hydrostatic Extrusion

Q-1	Hydrostatic Extrusion of Metals, N. AHMED and F. J. JANETT, Western Electric Company	695
Q-2	Production Experience With Hydrostatic Extrusion of Copper Tubes, T. JOHANNISSON, ASEA AB	705
Q-3	The Mod III Continuous Hydrostatic Extruder, J. K. O'DONNELL, Western Electric Company	713
Q-4	Hydrostatic Extrusion of Rosin Core Solder Wire, N. AHMED, Western Electric Company	721
Q-5	Development of a Disc Extruder for Continuous Hydrostatic Extrusion, J. S. CARTWRIGHT, Western Electric Company	729
Q-6	Extrusion Pressure vs. Extrusion Ratio Relation for the Hydrostatic Extrusion of Solid Polymers, N. INOUE and T. NAKAYAMA, Science University of Tokyo, and M. SHIMONO, Nippon Steel Corporation	736
Q-7	Effects of Temperature and Strain Rate on Deformation of Polymers During Hydrostatic Extrusion, N. INOUE and T. NAKAYAMA, Science University of Tokyo, and M. SHIMONO, Nippon Steel Corporation	741
Q-8	Effects of Hydrostatic Extrusion on the Thermal Properties of Amorphous Polymers, T. ARIYAMA, T. NAKAYAMA and N. INOUE, Science University of Tokyo ..	747
Q-9	Dislocation Characteristics in a Hydrostatically Compressed Crystal, V. T. SHMATOV, Institute of Physics of Metals	753

R. High Pressure Metal Working

R-1	Isostatic Metal Forming at AWRE, P. K. MINTER, Atomic Weapons Research Establishment	763
R-2	Cold Working of Titanium and Ti6Al4V Alloy by Hydrostatic Extrusion, J. BREME and U. ZWICKER, Universität Erlangen-Nürnberg	773

S. Explosive Forming and Welding

S-1	Explosive Welding: Applications and Techniques, D. R. HAY, Centre de Développement Technologique	781
S-2	An Experimental Investigation and Explosive Welding Parameters, B. CROSSLAND, F. A. MC KEE and A. SZECKET, The Queen's University of Belfast	805

S-3	Explosive Compaction of Powdered Materials, R. PRÜMMER, Institut für Chemie der Treib- und Explosivstoffe	814
S-4	Shock Thermomechanical Processing of Superalloys, H. E. OTTO, University of Denver	821

V. FUTURE DIRECTIONS IN HIGH PRESSURE APPLICATIONS

T. Investigations of Extremes of Pressure and Temperature

T-1	Investigations at the Megabar Range of Pressures, L. F. VERESCHAGIN, E. N. YAKOVLEV, Yu. A. TIMOFEEV and B. V. VINOGRADOV, Institute for High Pressure Physics, USSR Academy of Sciences	834
T-2	A Split Sphere 60,000 Ton Press, J. WANAGEL and A. L. RUOFF, Cornell University	840
T-3	Thermophysical and Transport Properties of Metals at High Pressure and Very High Temperature, J. W. SHANER and G. R. GATHERS, Lawrence Livermore Laboratory, University of California	847

U. Shock Wave Methods and Investigations

U-1	Measurement of Wave Profiles in Shock-Loaded Solids, R. A. GRAHAM, Sandia Laboratories	854
U-2	Shock-Induced Polarization in Polar Materials, M. DE ICAZA-HERRERA, Universidad Nacional Autónoma de México, and A. MIGAULT and J. JACQUESSON, Université de Poitiers	870
U-3	Initial Temperature Effect on the Shock Parameters of Some Liquids, F. L. YARGER, New Mexico Highland University, and F. E. PRIETO, Instituto Nacional de Energía Nuclear, and C. RENERO, Universidad Nacional Autónoma de México	878
U-4	Flash X-ray Diffraction System Combined with Double Stage Light Gas Gun for Crystallography During Shock- Compression, K. KONDO, T. MASHIMO, A. SAWAOKA and S. SAITO, Tokyo Institute of Technology	883
U-5	Measurement of Post-Shock Temperatures in Aluminum and Stainless Steel, S. A. RAIKES and T. J. AHRENS, California Institute of Technology	889
U-6	Absorption Spectroscopy in Solids Under Shock Compression, T. GOTO, G. R. ROSSMAN and T. J. AHRENS, California Institute of Technology	895

U-7	Microscopic Observation of the Shock-Compressed State of LiF by Flash X-ray Diffraction, K. KONDO, A. SAWAOKA and S. SAITO, Tokyo Institute of Technology	905
U-8	Acceleration of Flat Plates by Multiple Staging, G. R. FOWLES, C. LEUNG and R. RABIE, Washington State University, and J. SHANER, Lawrence Livermore Laboratory, University of California	911
U-9	Shell Structure Effects in Compressed Aluminum, A. K. MC MAHAN and M. ROSS, Lawrence Livermore Laboratory, University of California	920
U-10	Compression-Shear Waves in Arkansas Novaculite, L. R. KOLLER and G. R. FOWLES, Washington State University	927

V. Future Materials and Techniques for High Pressure Research

V-1	High Pressure Cryogenic Seals for Pressure Vessels, A. E. BUGGELE, NASA Lewis Research Center	935
V-2	Sliding Anvil High Pressure Apparatus: Description, Performance, Ability to Measure Very Small Changes of Volume and Application to the Determination of the Volume Change of Cerium at About 51 Kbar and 20°C, R. EPAIN, G. BOCQUILLON, A. FRELAT and C. LORIERS-SUSSE, Laboratories de Bellevue, C.N.R.S., and B. VODAR, Centre Universitaire Paris Nord, and H. MERX and C. MOUSSIN, Centre d'Etudes de Bruyères-le-Châtel	946
V-3	High Pressure Apparatus for Hydrogen Isotopes to Pressures of 345 MPa (50,000 psi) and Temperatures of 1200°C, J. F. LAKNER, Lawrence Livermore Laboratory, University of California	953
V-4	Future Trends in High Pressure — High Temperature Synthesis of Superconducting Materials, E. F. SKELTON and A. W. WEBB, Naval Research Laboratory	960

W. Exotic Methods in Very High Pressure Research

W-1	High Pressure Generation by Means of Pulsed Magnetic Fields, S. G. ALIKHANOV, V. P. BAKHTIN, A. D. MUZYCHENKO and V. P. NOVIKOV, The Kurchatov Institute of Atomic Energy	974
W-2	Future Pulsed Magnetic Field Applications in Dynamic High Pressure Research, C. M. FOWLER and R. S. CAIRD, Los Alamos Scientific Laboratory, University of California, and R. S. HAWKE and T. J. BURGESS, Lawrence Livermore Laboratory, University of California.	981

CONTENTS OF VOLUME 2

xv

W-3 Equation of State Experiments in the Pressure Region Near 20 Megabars, C. E. RAGAN III, M. G. SILBERT and B. C. DIVEN, Los Alamos Scientific Laboratory, University of California	993
Contents of Volume 1	1003
Author Index	1017
Subject Index, Volume 2	1023