

# NASA Technical Memorandum 4067

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## Microgravity Science and Applications Bibliography

*1987 Revision*

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*1987 Revision*

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Washington, D.C.*



National Aeronautics  
and Space Administration

Scientific and Technical  
Information Division

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## FOREWORD

This edition of the Microgravity Science and Applications (MSA) Bibliography is a comprehensive compilation of government reports, contractor reports, conference and symposia proceedings, and journal articles dealing with flight experiments utilizing a low-gravity environment to elucidate and control various processes, and with ground-based activities that provide supporting research. It encompasses literature published but not cited in the 1986 Revision, and literature published during the 1987 and 1988.

All papers are on file and copies can be made available to workers in the field on request to the bibliographer.

Any omissions that might have occurred are sincerely regretted. Investigators are encouraged to submit to the bibliographer, information on any work that was inadvertently omitted, or any new work, for inclusion in next year's edition of the Bibliography. All correspondence concerning corrections, additions, or deletions to the Microgravity Science and Applications Bibliography should be directed to: Ms. Elizabeth Pentecost, USRA, Suite 303, 600 Maryland Ave., SW, Washington, DC 20024.

The Microgravity Science and Applications Division wishes to thank the Universities Space Research Association (USRA) and in particular Ms. Elizabeth Pentecost, for her efforts in the compilation and publication of this report.

Robert J. Naumann, Acting Director  
Microgravity Science and  
Applications Division

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**MICROGRAVITY SCIENCE AND APPLICATIONS PROGRAM**



## **A. U.S. PROGRAM**



## Electronic Materials

Adornato, P. M. and Brown, R. A., "The Effect of Ampoule on Convection and Segregation During Vertical Bridgman Growth of Dilute and Non-dilute Binary Alloys," J. Cryst. Growth **80**, 155-190 (1987).

Adornato, P. M. and Brown, R. A., "Petrov-Galerkin Methods for Natural Convection in Directional Solidification of Binary Alloys," Int. J. Num. Meth. Fluids **7**, 761-791 (1987).

Andrews, R. N., Szofran, F. R., and Lehoczky, S. L., "Growth and Characterization of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  Alloys," J. Cryst. Growth, 1988 (in press).

Andrews, R. N., Szofran, F. R., and Lehoczky, S. L., "Internal Temperature Gradient of Alloy Semiconductor Melts from Interrupted Growth Experiments," J. Cryst. Growth, 1988 (in press).

Barber, P. and Coleman, J., "Electrochemical Growth of Crystals in Gels," NASA Tech Briefs **13**, 48 (1988).

Barber, P., Crouch, R. K., Fripp, A. L., Debnam, W. J., and Simchick, R. T., "Image of Liquid Solid Interfaces in Directionally Solidified Crystals," NASA Tech Briefs **13**, 42 (1988).

Bellows, A. H. and Duchene, G. A., "A Payload for Investigating the Influence of Convection on GaAs Crystal Growth," in *Proceedings of 1987 Get Away Special Experimenters Symposium* (N. Barthelem, ed.), NASA CP 2438, 1987, pp. 77-82.

Brown, R. A., "Modelling of Transport Processes in Melt Crystal Growth," in *Proceedings of First International Conference on the Processing of Electronic Materials* (C. Law, and R. Pollard, eds.), Springer-Verlag, 1987, pp. 354-3866 (in press).

Brown, R. A., "Interactions Between Convection, Segregation and Interface Morphology," in *Advanced Crystal Growth* (P.M. Dryburgh, B. Cockayne, and K.G. Barraclough, eds.), Prentice-Hall, 1987, pp. 41-95.

Bryskiewicz, T., Boucher, C. F., Lagowski, J., and Gatos, H. C., "Bulk GaAs Crystal Growth by Liquid Phase Electroepitaxy," J. Cryst. Growth **82**, 279-288 (1987).

Buchan, N. I. and Rosenberger, F., "Mass Spectroscopic Characterization of the  $\text{GeSe:GeI}_4$  Vapor Transport," J. Cryst. Growth, 1986 (submitted).

Carlson, D. J. and Witt, A. F., "Determination of Free Charge Carrier Distribution and Micro-Segregation of Dopants in n-Type GaAs," J. Cryst. Growth, 1988 (accepted).

Carlson, F. M. and Shen, J., "The Effect of Gravitational Field Strength on Steady State Thermal Convection in Birdgman-Stockbarger Crystal Growth," J. Cryst. Growth, submitted,

Chandra, D. and Wiedemeier, H., "A Thermodynamic Model of the  $\text{Hg}_{0.8}\text{Cd}_{0.2}\text{Te}$ -Iodine Transport System. I. Te-Saturated Source Material," Z. Anorg. Allg. Chem. **545**, 98 (1987).

- Cobb, S. D., Andrews, R. N., Szofran, F. R., and Lehoczky, S. L., "Characterization of Directionally Solidified  $\text{Hg}_{1-x}\text{Zn}_x\text{Se}$  Alloys," *J. Cryst. Growth*, 1988 (in press).
- Crouch, R. K., Fripp, A. L., Debnam, W. J., Woodell, B. A., Clark, I. O., Carlson, F. M., and Simchick, R. T., "Results from a Compound Semiconductor Crystal Growth Experiment in Low Gravity Environment," in *Proceedings of SAMPE Electronics Materials and Processes Conference*, 1987.
- Dakhoul, Y. M., Farmer, R., Lehoczky, S. L., and Szofran, F. R., "Numerical Simulation of Heat Transfer during the Crystal Growth of  $\text{HgCdTe}$  Alloys," *J. Cryst. Growth* **86**, 49 (1988).
- Gerbi, D. J., Egbert, W. C., and Cook, E. L., "Growth of Organic Crystals in a Microgravity Environment," *J. Cryst. Growth*, 1985 (submitted).
- Kafalas, J. A. and Bellows, A. H., "A Comparative Study of the Influence of Buoyancy Driven Fluid Flow on GaAs Crystal Growth," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 525-527.
- Kang, C. H., Lagowski, J., and Gatos, H. C., "Characteristics of GaAs with Inverted Thermal Convection.," *J. Appl. Phys.* **62**, 3482 (1987).
- Kang, C. H., Kondo, K., Lagowski, J., and Gatos, H. C., "Arsenic Ambient Conditions Preventing Surface Degradation of GaAs during Capless Annealing at High Temperatures," *J. Electrochem. Soc.* **134**, 1261 (1987).
- Kim, D-H., Adornato, P. M., and Brown, R. A., "Effect of Vertical Magnetic Field on Convection and Segregation in Vertical Bridgman Crystal Growth," *J. Cryst. Growth*, 1988 (in press).
- Lagowski, J., Bugajski, M., Matsui, M., and Gatos, H. C., "Optical Characterization of Semi-insulating GaAs: Determination of the Fermi Energy, the Concentration of the Midgap EL2 Level and Its Occupancy," *Appl. Phys. Lett.* **51**, 511 (1987).
- Lehoczky, S. L. and Szofran, F. R., "Growth of Solid Solution Single Crystals," in *The Nation's Future Materials Needs, International SAMPE Technical Conference Series*, Volume 19 (T. Lynch, et al., eds.), SAMPE, 1987, p. 332.
- Lehoczky, S. L., Szofran, F. R., Su, C-H., Cobb, S., and Andrews, R. N., "Crystal Growth of Solid Solution Systems by Directional Solidification," in *Proceedings of ASM International '87 Materials Congress*, 1987, in press.
- Lin, C., Carlson, D. J., and Witt, A. F., "Growth Related Residual Strain in LEC GaAs," *J. Cryst. Growth*, 1988 (accepted).
- Matthiesen, D. H., Wargo, M. J., and Witt, A., "Crystal Growth," in *Opportunities for Academic Research in Low Gravity Environment*, Volume 108 (G.A. Hazelrigg and J.M. Reynolds, eds.), AIAA, 1986, pp. 125-144.
- Matthiesen, D. H., Wargo, M. J., Motakef, S., Carlson, D. J., Nakos, J. A., and Witt, A., "Dopant Segregation during Vertical Bridgman-Stockbarger Growth with Melt Stabilization by Strong Axial Magnetic Fields," *J. Cryst. Growth*, in press.

- Matthiesen, D. H., Wargo, M. J., and Witt, A., "Melt Stabilization during Crystal Growth: A Comparative Analysis of the Effectiveness of Magnetic Fields and Reduced Gravity," J. Cryst. Growth, submitted.
- Motakef, S. and Witt, A. F., "Thermoelastic Analysis of GaAs in LEC Growth Configuration, Part I: Effect of Liquid Encapsulation on Thermal Stresses," J. Cryst. Growth, 1986 (submitted).
- Palosz, W. and Wiedemeier, H., "On the Mass Transport Properties of the GeSe-GeI<sub>4</sub> System under Normal and Reduced Gravity Conditions," J. Cryst. Growth, 1987 (in press).
- Rosenberger, F., "Inorganic and Protein Crystal Growth, Similarities and Differences," J. Cryst. Growth 76, 618 (1986).
- Rosenberger, F., "Fundamentals of Crystal Growth from Vapors," in *Crystal Growth in Science and Technology* (H. Areds, ed.), North Holland Press, 1988.
- Singh, N. B., "Convection and Diffusion Effects during Physical Vapor Transport of Hg<sub>2</sub>Cl<sub>2</sub>," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 71-76.
- Singh, N. B., "Growth and Characteristics of Mercurous Chloride Crystals," J. Cryst. Growth 83, 334 (1987).
- Stinespring, C. D., Annen, K. D., and Voltin, G. E., "Modeling Free Convective and Chemical Effects in CVD," J. Electrochem. Soc., 1985 (submitted).
- Su, C-H., "Heat Capacity, Enthalpy of Mixing and Thermal Conductivity of Hg<sub>1-x</sub>Cd<sub>x</sub>Te Pseudobinary Melts," J. Cryst. Growth 78, 51 (1986).
- Su, C-H., Lehoczky, S. L., and Szofran, F. R., "A Method to Eliminate Wetting During the Homogenization of HgCdTe," J. Appl. Phys. 60, 3777 (1986).
- Su, C-H., Lehoczky, S. L., and Szofran, F. R., "Growth of HgZnTe Alloy Crystals by Directional Solidification," J. Cryst. Growth, 1988 (in press).
- Su, C-H., Perry, G.L.E., Szofran, F. R., and Lehoczky, S. L., "Compositional Redistribution during Casting of Hg<sub>0.8</sub>Cd<sub>0.2</sub>Te Alloys," J. Cryst. Growth, 1988 (in press).
- Szofran, F. R. and Lehoczky, S. L., "Bridgman Growth of Mercury Cadmium Telluride Alloys," in *Processing of Electronic Materials* (C.G. Law and R. Pollard, eds.), AICHE, 1987, pp. 342-348.
- Taylor, R. E., Holland, L. R., and Crouch, R. K., "Thermal Diffusivity Measurements of Some Molten Semiconductors," High Temp. High Press., in press.
- Trivedi, S. B. and Wiedemeier, H., "Modified Bridgman Growth and Etching of Cd<sub>0.96</sub>Zn<sub>0.04</sub>Te Crystals," J. Electrochem. Soc. 134, 3199 (1987).
- Ungar, L. H. and Brown, R. A., "Finite Element Methods for Unsteady Solidification, Problems Arising in the Prediction of Morphological Structure," J. Sci. Comput., 1988 (in press).

Van den Berg, L. and Schneppe, W. F., "Growth of Mercuric Iodide in Spacelab III," in *The Nation's Future Materials Needs, International SAMPE Technical Conference Series*, Volume 19 (T. Lynch et al., eds.), SAMPE, 1987.

Walukiewicz, W., Wang, L., Pawlowicz, L. M., Lagowski, J., and Gatos, H. C., "Effects of Macroscopic Inhomogeneities on Electron Mobility in Semi-insulating GaAs," Appl. Phys. Lett. **59**, 3144 (1986).

Wiedemeier, H. and Trivedi, S. B., Whiteside, R. C., and Palosz, W., "The Heat of Formation of Mercury Vacancies in  $\text{Hg}_{0.8}\text{Cd}_{0.2}\text{Te}$ ," J. Electrochem. Soc. **133**, 2399 (1986).

Wiedemeier, H. and Trivedi, S. B., "Initial Observations of GeSe-Xenon Transport Experiments Performed on the D-1 Space Flight," Naturwissenschaften **73**, 376 (1986).

Wiedemeier, H. and Chandra, D., "A Thermodynamic Model of the  $\text{Hg}_{0.8}\text{Cd}_{0.2}\text{Te}$ -Iodine Transport System. II. Source Material Composition within the Homogeneity Range," Z. Anord. Allg. Chem. **545**, 109 (1987).

Wiedemeier, H. and Chang, C. L., "The Pressure-Temperature Phase Diagram of the HgTe System from Dynamic Mass Loss Measurements," J. Less-Common Metals, 1987 (in press).

Wiedemeier, H. and Palosz, W., "Response to the Comment by R.F. Brebrick on the Paper by H. Wiedemeier et al. entitled, 'The Heat of Formation of Mercury Vacancies in  $\text{Hg}_{0.8}\text{Cd}_{0.2}\text{Te}$ ,'" J. Electrochem. Soc., in press.

Yoo, H-D., Wilcox, W. R., Lal, R. B., and Trolinger, J. D., "Modelling the Growth of Triglycine Sulfate (TGS) Crystals in Spacelab-3," J. Cryst. Growth, submitted.

## Metals, Alloys, and Composites

Bahrami, P. A. and Wang, T. G., "Analysis of Gravity and Conduction Driven Melting in a Sphere," J. Heat Transfer, 1986 (submitted).

Bayuzick, R. J., Evans, N. D., and Kenik, E. A., "Metastable Structures in Drop Tube Processed Niobium Based Alloys," Adv. Space Res. 5, 123 (1986).

Bethin, J., Larson, D. J. and Dressler, B. S., "Orbital Processing of Aligned Magnetic Composites," in *Annual Report of Francis Bitter National Magnet Laboratory*, MIT Press (in press).

Boettinger, W. J. and Perepezko, J. H., "Fundamentals of Rapid Solidification in Rapidly Solidified Crystallizing Alloys," (C. Adams, S. Das, and B. Kear, eds.), AIME (in press).

Brattkus, K. and Davis, S. H., "Directional Solidification in an Imperfect Furnace," Physicochem. Hydrodynam. 9, 9 (1987).

Cezairliyan, A. and McClure, J. L., "A Microsecond-Resolution Transient Technique for Measuring the Heat of Fusion of Metals: Niobium," Int. J. Thermophys. 8, 577 (1987).

Cezairliyan, A. and McClure, J. L., "Heat Capacity and Electrical Resistivity of Liquid Niobium neat Its Melting Temperature," Int. J. Thermophys. 8 (1987).

Chandrasakhar, Wisa, G. F., and Wilcox, W. R., "Influence of Convection on Lamellar Spacing of Eutectics," J. Cryst. Growth 76, 485-488 (1986).

Chen, F. and Chen, C. F., "Onset of Finger Convection in a Horizontal Porous Layer Underlying a Fluid Layer," J. Heat Transf., in press.

Chen, H. T., Myers, S. A., and Koch, C. C., "Rapidly Solidified Fe-Ni-Al-C Alloys: Metastable Phase Formation," Mat. Sci. & Engr., 1988 (in press).

Chopra, M. A., Burke, D., and Laxmanan, V., "Influence of an Applied Electric Field on the Solid-Liquid Interface Morphology in Pure Succinonitrile," J. Cryst. Growth, 1987 (submitted).

Collings, E. W., McCoy, J. K., Rayment, J. J., and Markworth, A. J., "Splat Quenching of Freely Falling Drops by Impact on a Cold Substrate," J. Mat. Sci.,

Collings, E. W. and Markworth, A. J., "Liquid-Drop Formation for Undercooling Experiments in Free Fall," Appl. Micro Techn., submitted.

Curreri, P. A., Lee, J. E., and Stefanescu, D., "Dendritic Solidification of Alloys in Low Gravity," Met. Trans., 1988 (in press).

DeGroh, H. C. and Laxmanan, V., "Bulk Nucleation and Macrosegregation of Pb-Sn Alloys," Met. Trans., 1988 (submitted).

Ecker, A., Alexander, J.I.D., and Frazier, D. O., "Simultaneous Temperature and Concentration Measurement in Front of Solidifying Monotectic Systems using the Two Wavelength Holographic Techniques," in *Proceedings of 6th European Symposium on Material Science under Microgravity Conditions*, ESA SP-256, 1987, pp. 309-311.

Eisa, G. F., "Effect of Convection on the Microstructure of MnBi/Bi Eutectic Solidified from the Melt," *J. Cryst. Growth* **78**, 159-174 (1986).

Facemire, B. R. and Frazier, D. O., "Separation Processes in Monotectic Systems," *Res. Mechan.*, 1987 (in press).

Flemings, M. C., Shiohara, Y., and Wu, Y., "Dendritic Growth of an Undercooled Nickel-Tin Alloy," in *Conference Proceedings of TMS-AIME Symposium on The Hume-Rothery Memorial Symposium on Undercooled Alloy Phases* (E.W. Collings and C.C. Koch, eds.), TMS-AIME, 1986, pp. 321-343.

Ganesan, S. and Poirier, D. R., "Densities of Aluminum-Rich Aluminum-Copper Alloys during Solidification," *Met. Trans. A* **18**, 721-723 (1987).

Ganesan, S., Speiser, R., and Poirier, D. R., "Viscosities of Aluminum-Rich Al-Cu Liquid Alloys," *Met. Trans. B* **18**, 421-424 (1987).

Glicksman, M. E. and Singh, N. B., "Microstructural Scaling Laws for Dendritically Solidified Aluminum Alloys," in *Rapidly Solidified Powder Aluminum Alloys ASTM-STP890* (M. E. Fine and E. A. Starke, eds.), ASTM, in press.

Glicksman, M. E., Winsa, E., Hahn, R. C., Lograsso, T. A., Rubinstein, E. R., and Selleck, M. E., "Isothermal Dendritic Growth - A Low Gravity Experiment," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 37-46.

Glicksman, M. E., Winsa, E., Hahn, R. C., Lograsso, T. A., Tirmizi, S., and Selleck, M., "Isothermal Dendritic Growth - A Proposed Microgravity Experiment," *Met. Trans.*, 1988 (accepted).

Graves, J. A. and Perepezko, J. H., "Undercooling and Crystallization Behavior of Antimony Droplets," *J. Mat. Sci.*, 1985 (in press).

Hansen, G. P., Krishnan, B., Hauge, R. H., and Margrave, J. L., "A New Method to Determine Temperature and Emissivity of Liquid Metals at Elevated Temperatures," *Trans. Met. Soc.*, 1988 (accepted).

Hardy, S. C. and Voorhees, P. W., "Ostwald Ripening in a System with a High Volume Fraction of Coarsening Phase," *Met. Trans. A*, 1988 (in press).

Harrison, K., Hallet, J., Burcham, T. S., Feeney, R. W., Kerr, W. L., and Yeh, Y., "Ice Growth in Supercooled Solutions of Antifreeze Glycoprotein," *Nature* **328**, 241-243 (1987).

- Heinrich, J. C., "Numerical Simulations of Thermosolutal Instability during Directional Solidification of a Binary Alloy," in *Computer Methods in Applied Mechanics and Engineering*, 1987 (in press).
- Hellawell, A., "Local Convective Flow in Partly Solidification Systems," NATO ASI Series E 125, 3-22 (1987).
- Hellawell, A., "Channel Formation during Alloy Solidification," in *Indo-U.S. Scientific Workshop on Solidification Processing* (R. Trivedi, ed.), ONR, 1988 (in press).
- Hofmeister, W. H., Robinson, M. B., and Bayuzick, R. J., "Undercooling of Pure Metals in a Containerless Microgravity Environment," Appl. Phys. Lett. **49**, 1342 (1986).
- Hofmeister, W. H., Robinson, M. B., and Bayuzick, R. J., "Undercooling of Bulk High Temperature Metals in the 100 Meter Drop Tube," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 149-162.
- Ilegbusi, O. J. and Szekely, J., "On the Flow Criteria for Suspending Solids in Electromagnetically-Stirred Melts," Met. Trans. B, 1987 (in press).
- Ilegbusi, O. J. and Szekely, J., "Criteria for Particles Engulfment by an Electromagnetically-Stirred Melt," J. Colloid & Interface Sci., 1987 (in press).
- Ilegbusi, O. J. and Szekely, J., "The Electromagnetic Stirring of Non-Newtonian Fluids," Trans. Iron & Steel Inst. Japan, 1987 (in press).
- Jayaraman, N. and Tewari, S. N., "Fault Structures in Rapidly Quenched Ni-Mo Binary Alloys," Met. Trans. **17A**, 2291 (1986).
- Kaukler, W. F. and Frazier, D. O., "Crystallization Microstructure in Transparent Monotectic Alloys," Nature **323**, 50-52 (1986)
- Kendall, J. M., "Experiments of Annular Liquid Jet Instability and on the Formation of Liquid Shells," Phys. Fluids, 1986 (in press).
- Kipphut, C. M., Kishi, T., Bose, A., and German, R. M., "Gravitational Contributions to Microstructural Coarsening in Liquid Phase Sintering," Progress in Powder Metallurgy **43**, 93-106 (1987).
- Kipphut, C. M., Bose, A., Farooq, S., and German, R. M., "Configurational Energy Induced Microstructural Changes in Liquid Phase Sintering," Met. Trans., 1988 (in press).
- Kipphut, C. M. and German, R. M., "Alloy Phase Stability in Liquid Phase Sintering," Science of Sintering, 1988 (in press).
- Knight, A. C., Hallet, J., and Devries, A. L., "Solute Effects on Ice Recrystallization: An Assessment Technique," J. Cryobiology **25**, 55-60 (1988).
- Krishnam, S., Hansen, G. P., Hauge, R. H., and Margrave, J. L., "Studies on Dynamics of Levitated Liquid Metals at Elevated Temperatures," Trans. Met. Soc., 1988 (accepted).

Laxmanan, V., "Transition from Planar to Cellular to Dendritic Microstructures During Rapid Solidification Processing," in *Rapidly Solidified Materials and Their Mechanical and Magnetic Properties*, Volume 58 (B.C. Giessen, D.E. Polk, and A.I. Taub, eds.), MRS, 1986, pp. 41-50.

Laxmanan, V., "Cellular and Dendritic Growth in a Binary Alloy Melt: A Marginal Stability Approach," *J. Cryst. Growth* **75**, 573-590 (1986).

Laxmanan, V., "Dendritic Growth in a Supercooled Alloy Melt," in *Undercooled Alloy Phases* (E.W. Collings and C.C. Koch, eds.), TMS, 1987, pp. 453-496.

Laxmanan, V., "Dendritic Solidification in a Binary Alloy Melt: Comparison of Theory and Experiment," *J. Cryst. Growth* **83**, 391-402 (1987).

Laxmanan, V., "On Producing an Alloy of Uniform Composition During Rapid Solidification Processing," in *Enhanced Properties in Structural Metals by Rapid Solidification* (F.H. Froes and D.J. Savage, eds.), ASM, 1987 (in press).

Laxmanan, V., Studer, A., Wang, L., Wallace, J. F., and Winsa, E. A., "Gravitational Macroseggregation in Binary Pb-Sn Alloy Ingots," NASA TM 89885, 1987.

Lee, M. C. and Allen, J. L., "Noncontact True Temperature Measurement," *Mat. Res. Soc. Symp. Proc.* **87**, 285-293 (1987).

Lee, M. C. and Allen, J. L., "Noncontact True Temperature Measurement II," in *Proceedings of Noncontact Temperature Measurement Workshop*, NASA CP-2503, 1988.

Lipton, J., Kurz, W., and Glicksman, M. E., "Equiaxed Dendrite Growth in Alloys at Small Supercooling," *Met. Trans.* **18A**, 341-345 (1987).

Loo, B. H., Lee, Y. G., and Frazier, D. O., "Enhanced Raman Spectroscopic Study of Rotational Isomers on Metal Surfaces," in *Laser Applications in Chemistry and Biophysics*, SPIE Volume 620, 1986, pp. 117-125.

Lowry, S. A., McCay, M. H., McCay, T. D., and Gray, P. A., "Surface Tension Measurements in Aqueous Ammonium Chloride (NH<sub>4</sub>Cl) in Air," *J. Phys. Chem.*, 1988 (submitted).

Markworth, A. J., "A Kinematical Model of Liquid-Drop Solidification due to Multiple Surface-Nucleation Events," *Mat. Sci. Engr.*, in press.

Marsh, S. P. and Glicksman, M. E., "Adiabatic Recalescence Kinetics of Supercooled Pure Melts," in *Modelling and Control of Casting and Welding Processes* (S. Kou and R. Mehrabian, eds.), AIME, 1986, pp. 579-589.

Marsh, S. P. and Glicksman, M. E., "Microstructural Coarsening in 2- and 3-Dimensions-Applications of Multiparticle Diffusion Algorithms," in *Computer Simulation of Microstructural Evolution* (D.J. Srolovitz, ed.), TMS/AIME, 1987, pp. 109-124.

McCay, M. H., Lee, J. E., and Curreri, P. A., "The Effect of Gravity Level on the Average Primary Dendrite Spacing of a Directionally Solidified Superalloy," *Met. Trans.* **17A**, 2301-2303 (1986).

- McCay, M. H. and McCay, T. D., "Measurement of Solutal and Thermal Layers in Unidirectional Solidification," J. Thermophys. & Heat Transf., 1988 (in press).
- McCay, T. D. and McCay, M. H., "An Inclusive Static Stability Criteria for Freckling in Directional Solidification of Metal Models and Alloys," Met. Trans. A, 1988 (submitted).
- McCoy, J. K., Markworth, A. J., Brodkey, R. S., and Collings, E. W., "Analysis of the Free-Fall Behavior of Liquid-Metal Drops in a Gaseous Atmosphere," in *Material Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 163-172.
- McCoy, J. K., Markworth, A. J., Brodkey, R. S., and Collings, E. W., "Cooling and Solidification of Liquid-Metal Drops in a Gaseous Atmosphere," Adv. Space Res.,
- McFadden, G. B., Voorhees, P. W., Boisvert, R. F., and Meiron, D. I., "A Boundary Integral Method for the Simulation of Two-Dimensional Particle Coarsening," J. Sci. Compt. 1, 117 (1986).
- Michal, G. M., Laxmanan, V., and Glasgow, T. K., "Crystallization Behavior of a Melt-Spun Fe-Ni Based Steel," in *Undercooled Alloy Phases* (E.W. Collings and C.C. Koch, eds.), TMS, 1987, pp. 95-107.
- Murthy, A. and Szekely, J., "Some Fundamental Aspects of Mixing in Metallurgical Reaction Systems," Met. Trans. B, 1985 (accepted).
- Perepezko, J. H., "Non-Contact Temperature Measurement Requirements and Applications for Metals and Alloys Research," in *NonContact Temperature Measurement, Workshop Proceedings*, NASA CP-2503, 1988, pp. 79-106.
- Perepezko, J. H., Grqves, J. A., and Mueller, B. A., "Rapid Solidification of Highly Undercooled Liquids," in *Processing of Structural Metals by Rapid Solidification* (F.H. Froes and S.J. Savage, eds.), ASM, 1987, p. 13.
- Piccone, T. J., Wu, Y., Shiohara, Y., and Flemings, M. C., "Dendritic Growth of Undercooled Nickel-Tin: Part II," Met. Trans. A 18, 925-932 (1987).
- Piccone, T. J., Harf, F. H., Wu, Y., Shiohara, Y., Flemings, M. C., and Winsa, E. A., "Solidification of Undercooled Ni-Sn Eutectic Alloy under Microgravity Conditions in the Space Shuttle," in *Materials Research Society Proceedings Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 47-56.
- Poirier, D. R. and Speiser, R., "Surface Tension of Aluminum-Rich Al-Cu Liquid Alloys," Met. Trans. A 18, 1156-1160 (1987).
- Poirier, D. R., Yeum, K., and Maples, A. L., "A Thermodynamic Prediction for Microporosity in Aluminum-Rich Al-Cu Alloys," Met. Trans. 18A, 1979 (1987).
- Poirier, D. R. and Yeum, K., "Modelling Interdendritic Porosity," in *Proceedings of Solidification Technology 1987*, 1987 (in press).

- Poirier, D. R., "Densities of Pb-Sn Alloys During Solidification," Met. Trans. **19B**, 1988 (in press).
- Popov, D. and Wilcox, W. R., "Influence of Convection on Spiral Structures of Lead-Tin Eutectic," J. Cryst. Growth **78**, 175-176 (1986).
- Potts, H. and Wilcox, W. R., "Thermal Fields in the Bridgman-Stockbarger Technique," J. Cryst. Growth **73**, 350-358 (1986).
- Potts, H. and Wilcox, W. R., "Chaotic Asymmetric Convection in the Bridgman-Stockbarger Technique," J. Cryst. Growth **74**, 443-445 (1986).
- Riley, C., Coble, D., and Maybee, G., "Electrodeposition of Metals and Metal/Cermet Composites in Low Gravity," in *Proceedings of AIAA 25th Aerospace Sciences Meeting*, 1987, AIAA 87-0510.
- Riley, C., Coble, H. D., Loo, B., Benson, B., and Abi-Akar, H., "Electrodeposition and Dodeposition under Low Gravity/Nonconvecting Conditions," Polymer Preprints **28**, 470 (1987).
- Sarazin, J. R. and Hellawell, A., "Channel Formation in Pb-Sn, Pb-Sb and Pb-Sn-Sb Alloy Ingots and Comparison with the System  $\text{NH}_4\text{Cl-H}_2\text{O}$ ," Met. Trans. A., 1988 (in press).
- Sarazin, J. R. and Hellawell, A., "Channel Flow in Partly Solidified Alloy Systems," in *Proceedings of Symposium on Advances in Phase Transitions*, Pergamon Press, 1988 (in press).
- Sekerka, R. F., Voorhees, P. W., Coriell, S. R., and McFadden, G. B., "Initial Conditions Implied by  $t^{1/2}$  Solidification of a Sphere with Capillary and Interfacial Kinetics," J. Cryst. Growth **87**, 415 (1988).
- Sen, R. and Wilcox, W. R., "Behavior of a Non-Wetting Melt in Free Fall: Experimental," J. Cryst. Growth **74**, 591-596 (1986).
- Sen, R. and Wilcox, W. R., "Behavior of a Non-Wetting Melt in Free Fall: Theoretical," J. Cryst. Growth **78**, 129-134 (1986).
- Shih, W. H., Ebner, C., and Stroud, D., "Potts Lattice Gas Model for the Solid-Liquid Interfacial Tensions of Simple Fluids," Phys. Rev B (in press).
- Shih, W. H. and Stroud, D., "Two-Component Lattice Gas Model for Surface Segregation in Liquid Alloys," Phys. Rev B (in press).
- Shih, W. Y., Hirth, J. P., and Stroud, D., "Twin Boundary Energy and Entropy of Simple Metals: A Constant Pressure Monte Carlo Calculation for Al," Phys. Rev. B (in press).
- Shiohara, Y., Piccone, T. J., Wu, Y., and Flemings, M. C., "Recalescence of Undercooled Nickel-Tin Alloy," Met. Trans. A., 1986 (submitted).

Shong, D. S., Graves, J. A., Ujie, Y., and Perepezko, J. H., "Containerless Processing of Undercooled Melts," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 17-27.

Stefanescu, D., Dhindaw, B. K., Kacar, A. S. and Moitra, A., "Behavior of Ceramic Particles at the Solid-Liquid Metal Interface in Metal Matrix Composites," Met. Trans., 1988 (in press).

Studer, A. and Laxmanan, V., "Fraction Eutectic Measurements in Slowly Cooled Pb 15%Sn Alloy Ingots," in *Conference on Solidification Processing for Eutectic Alloys*, 1987 (in press).

Tewari, S. N., "Effect of Undercooling on the Microstructure of Ni-35%Mo (Eutectic) and Ni-38%Mo (Hypereutectic) Alloys," Met. Trans. 18A, 525-542 (1987).

Tewari, S. N., "Undercooling in Ni-31%Mo Alloys," J. Cryst. Growth, (submitted).

Tewari, S. N., "Microsegregation in Directionally Solidified Pb-8.4 at %Au Alloy," Met. Trans., 1987 (in press).

Tewari, S. N., "Dendrite Characteristics in Directionally Solidified Pb-8%Au and Pb-3%Pd Alloys," Met. Trans. 17A, 2279 (1986).

Tewari, S. N. and Laxmanan, V., "A Critical Examination of the Dendrite Growth Models: Comparison of Theory with Data," Acta Met. 35, 175-183 (1987).

Tewari, S. N. and Laxmanan, V., "Cellular Dendritic Transition in Directionally Solidified Binary Alloys," Met. Trans. 18A, 167-170 (1987).

Tewari, S. N. and Glasgow, T. K., "Undercooled and Rapidly Quenched Ni-Mo Alloys," in *Proceedings of Symposium on Undercooled Alloy Phases* (E.W. Collings and C.C. Koch, eds.), TMS, 1987.

Tewari, S. N. and Glasgow, T. K., "Cellular Microstructure of Chill Block Melt Spun Ni-Mo Alloys," Met. Trans. 18A, 1663 (1987).

Trinh, E. H., Marston, P. L., and Robey, J. L., "Acoustic Measurement of the Surface Tension of Levitated Drops," J. Colloid & Interface Sci., 1988 (in press).

Voorhees, P. W., McFadden, G. B., Boisvert, R. F., and Meiron, D. I., "Numerical Simulation of Morphological Development During Ostwald Ripening," Acta Met. 36, 207 (1988).

Wu, Y., Piccone, T. J., Shiohara, Y., and Flemings, M. C., "Microstructures of Undercooled Ni-Sn Alloys," Met. Trans. A., 1986 (submitted).

Wu, Y., Piccone, T. J., Shiohara, Y., and Flemings, M. C., "Dendritic Growth of an Undercooled Nickel-Tin: Part I," Met. Trans. A. 18, 915-924 (1987).

Yamamoto, M., Wu, Y., Shiohara, Y., and Flemings, M. C., "Comparison of Structures of Gas Atomized and of Emulsified Highly Undercooled Ni-Sn Alloy Droplets," in *Rapidly Solidified Alloys and Their Mechanical and Magnetic Properties*, Volume 58 (B.C. Giessen, D.E. Polk, and A.I. Taub, eds.), MRS, 1986, pp. 411-414.

Yeum, K. and Poirier, D. R., "Predicting Microporosity in Aluminum Alloys," in *Light Metals 1988* (L.G. Boxall, ed.), TMS-AIME, 1988, pp. 469-476.

Eisa, G. F., "Effect of Convection on the Microstructure of MnBi/Bi Eutectic Solidified from the Melt," J. Cryst. Growth **78**, 159-174 (1986).

Facemire, B. R. and Frazier, D. O., "Separation Processes in Monotectic Systems," Res. Mechan., 1987 (in press).

Flemings, M. C., Shiohara, Y., and Wu, Y., "Dendritic Growth of an Undercooled Nickel-Tin Alloy," in *Conference Proceedings of TMS-AIME Symposium on The Hume-Rothery Memorial Symposium on Undercooled Alloy Phases* (E.W. Collings and C.C. Koch, eds.), TMS-AIME, 1986, pp. 321-343.

Ganesan, S. and Poirier, D. R., "Densities of Aluminum-Rich Aluminum-Copper Alloys during Solidification," Met. Trans. A **18**, 721-723 (1987).

Ganesan, S., Speiser, R., and Poirier, D. R., "Viscosities of Aluminum-Rich Al-Cu Liquid Alloys," Met. Trans. B **18**, 421-424 (1987).

Glicksman, M. E. and Singh, N. B., "Microstructural Scaling Laws for Dendritically Solidified Aluminum Alloys," in *Rapidly Solidified Powder Aluminum Alloys ASTM-STP890* (M. E. Fine and E. A. Starke, eds.), ASTM, in press.

Glicksman, M. E., Winsa, E., Hahn, R. C., Lograsso, T. A., Rubinstein, E. R., and Selleck, M. E., "Isothermal Dendritic Growth - A Low Gravity Experiment," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 37-46.

Glicksman, M. E., Winsa, E., Hahn, R. C., Lograsso, T. A., Tirmizi, S., and Selleck, M., "Isothermal Dendritic Growth - A Proposed Microgravity Experiment," Met. Trans., 1988 (accepted).

Graves, J. A. and Perepezko, J. H., "Undercooling and Crystallization Behavior of Antimony Droplets," J. Mat. Sci., 1985 (in press).

Hansen, G. P., Krishnan, B., Hauge, R. H., and Margrave, J. L., "A New Method to Determine Temperature and Emissivity of Liquid Metals at Elevated Temperatures," Trans. Met. Soc., 1988 (accepted).

Hardy, S. C. and Voorhees, P. W., "Ostwald Ripening in a System with a High Volume Fraction of Coarsening Phase," Met. Trans. A, 1988 (in press).

Harrison, K., Hallet, J., Burcham, T. S., Feeney, R. W., Kerr, W. L., and Yeh, Y., "Ice Growth in Supercooled Solutions of Antifreeze Glycoprotein," Nature **328**, 241-243 (1987).

Heinrich, J. C., "Numerical Simulations of Thermosolutal Instability during Directional Solidification of a Binary Alloy," in *Computer Methods in Applied Mechanics and Engineering*, 1987 (in press).

## Fluid Dynamics and Transport Phenomena

Agosta, C., Wang, S., Cohen, L. H., and Meyer, H., "Transport Properties of Helium near the Liquid-Vapor Critical Point IV. The Shear Viscosity of  $^3\text{He}$  and  $^4\text{He}$ ," J. Low Temp. Phys. **67**, 237 (1987).

Alexander, J.I.D., Xiao, R-F., and Rosenberger, F., "Morphological Evolution of Growing Crystals - A Monte Carlo Simulation," Phys. Rev. A, 1988 (submitted).

Amin, N., "The Effect of G-jitter on Heat Transfer," in *Proceedings of the Royal Society of London*, 1988 (submitted).

Baird, J. K., Lee, L. K., Frazier, D. O., and Naumann, R. J., "Theory of Ostwald Ripening in a Two-Component System," NASA TM-86564, 1986.

Baird, J. K. and Frieden, R. W., "Rigorous Theory of the Diaphragm Cell When the Diffusion Coefficient Depends upon Concentration," J. Phys. Chem. **91**, 3920 (1987).

Balasubramanian, R., "Thermocapillary Bubble Migration for Large Marangoni Numbers," NASA CR 179628, 1987.

Balasubramanian, R. and Chai, A-T., "Thermocapillary Migration of Droplets: An Exact Solution for Small Marangoni Numbers," J. Colloid Interface Sci., 1987, in press.

Balasubramanian, R. and Ostrach, S., "Transport Phenomenon near the Interface of a Czochralski Crystal," J. Cryst. Growth (in press).

Banish, R. M., Xiao, R-F., and Rosenberger, F., "Vapor Concentration Measurement with Photothermal Deflection Spectroscopy," J. Appl. Phys., 1988 (submitted).

Berg, R. F., Moldover, M. R., Rabinovich, S., and Voronel, A., "Viscosity and Density of Two Alkali Metal Mixtures," J. Phys. F: Metal Phys. **17**, 1861 (1987).

Berg, R. F., Moldover, M. R., and Huang, J. S., "Quantitative Characterization of the Viscosity of a Microemulsion," J. Chem. Phys. **87**, 3261 (1987).

Brattkus, K. and Davis, S. H., "Directional Solidification in an Imperfect Furnace," Physiochem. Hydrodynam. **2**, 9 (1987).

Brattkus, K. and Davis, S. H., "Flow-Induced Morphological Instabilities: The Rotating Disc," J. Cryst. Growth **87**, 385-396 (1988).

Brown, R. A. and Leal, L. G., "Numerical Methods for Viscous Free-Surface Flows," Ann. Rev. Fluid Mech., 1988 (submitted).

Buchan, N. I. and Rosenberger, F., "Mass Spectroscopic Characterization of the GeSe:GeI<sub>4</sub> Vapor Transport System," J. Cryst. Growth **84**, 1645 (1987).

Chen, F. and Chen, C. F., "Onset of Finger Convection in a Horizontal Porous Layer Underlying a Fluid Layer," J. Heat. Transf. **110**, 403 (1988).

Chikhaoui, A., Maslanik, M. K., and Sani, R. L., "Three-dimensional Multicellular Convection in a Long Vertical Enclosure," Comptes Rendus Acad. Soc. Paris **305**, 1341-1347 (1987).

Chikhaoui, A., Bontoux, P., Maslanik, M. K., and Sani, R. L., "Steady Three-dimensional Thermal Convection in Vertical Rectangular Enclosure: Transition to Multicellular Flow," Commun. Appl. Num. Meth., 1988 (in press).

Chow, C. Y. and Harvanek, M., "Electromagnetic-Capillary Instabilities of a Hollow Liquid Cylinder: Production of Spherical Shells under Microgravity Conditions," in *Proceedings of First National Fluid Dynamics Congress*, July 1988 (submitted).

Concus, P. and Finn, R., "Continuous and Discontinuous Disappearance of Capillary Surfaces," in *Variational Methods for Free Surface Interfaces* (P. Concus and R. Finn, eds.), Springer-Verlag, 1987, pp. 197-204.

Coriell, S. R., McFadden, G. B., Voorhees, P. W., and Sekerka, R. F., "Stability of a Planar Interface during Solidification of a Multicomponent System," J. Cryst. Growth **82**, 295 (1987).

Crespo, E., Bontoux, P., Smutek, C., Roux, B., Hardin, G., Sani, R., and Rosenberger, F., "Three-dimensional Simulations of Convection Regimes in Cylindrical Ampoules. Comparisons with Theoretical Analyses and Experiments," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 529-537.

Danabasoglu, G. and Biringen, S., "Computation of Convective Flow with G-jitter in Rectangular Cavities," in *Proceedings of First National Fluid Dynamics Congress*, July 1988 (submitted).

Davis, S. H., "Crystal Growth from the Melt," in *Interdisciplinary Issues in Materials Processing and Manufacturing*, Volume 2 (S.K. Samanta, R. Komanduri, et al., eds.), ASME, 1987, pp. 593-597.

Duranceau, J. L. and Brown, R. A., "Analysis of the Coupling Between Melt Flow and Zone Shape in Small-Scale Floating Zones," J. Cryst. Growth, 1988 (submitted).

El-Kaddah, N., Szekely, J., Taberlet, E., and Fautrelle, Y., "Turbulent Recirculating Flow in Induction Furnaces, A Comparison of Measurements with Predictions over a Range of Conditions," Met. Trans., 1986 (submitted).

Engelman, M. S. and Sani, R. L., "Finite Element Simulation of Temperature Dependent Free Surface Flows," in *Proceedings of Fourth International Symposium on Numerical Methods in Thermal Problems*, Swansea, UK, 1985 (accepted).

Fowles, W. W. and Roberts, G. O., "Confinement of a Thermocapillary Floating Zone Flow by Uniform Rotation," J. Cryst. Growth **74**, 301 (1986).

Giarratano, P. J., Arp, V. D., Owen, R. B., Cezairliyan, A., and Miller, A. P., "Transient Heat Transfer and Thermophysical Properties Measurements in Low Gravity," Adv. Astron. Sci., 1987, in press.

Hardin, G. R., Sani, R. L., Henry, D., and Roux, B., "Buoyancy-Driven Instability in a Vertical Cylinder: Binary Fluids with Soret Effect. Part I: General Theory and Stationary Stability Results," Int. J. Num. Meth. Fluids, 1988 (submitted).

Hasan, M. M. and Balasubramanian, R., "Thermocapillary Migration of a Large Vapor Slug in a Tube," J. Thermophys. & Heat Transf., 1988 (accepted).

Hathaway, D. H. and Fowles, W. W., "Flow Regimes in a Shallow Rotating Cylindrical Annulus with Temperature Gradients Impose on the Horizontal Boundaries," J. Fluid Mech. 172, 401 (1986).

Homsy, G. M. and Donnelly, R. J., "Fluid Mechanics and Fluid Physics in a Low Gravity Environment," in *Opportunities for Academic Research in a Low Gravity Environment*, Volume 108 (G.A. Hazelrigg and J.M. Reynolds, eds.), AIAA, 1986, 231-246.

Kamotani, Y. and Kim, J., "Effect of Zone Rotation on Oscillatory Thermocapillary Flow in Simulated Floating Zones," J. Cryst. Growth 87 (1988).

Kassoy, D. R., Sani, R. L., and Koster, J. N., "Low-Gravity Research at the University of Colorado at Boulder," in *Science and Technology Series*, Volume 67 (J.N. Koster, ed.), AAS, 1987.

Kayser, R. F., "The Effect of Capillary Waves on Surface Tension," Phys. Rev. A33, 1948 (1986).

Kayser, R. F., "The Effect of Surface Ionization on Wetting Layers," Phys. Rev. Lett. 56, 1831 (1986).

Kayser, R. F., "Wetting of a Binary Liquid Mixture on Glass," Phys. Rev. B34, 3254 (1986).

Kayser, R. F., "Wetting Layers on Solid Substrates," KINAM (Mexico) 8, Series A, 87-105 (1987).

Kayser, R. F., "Wetting Layers in Electrolyte Solutions," J. de Phys., in press.

Kayser, R. F., Moldover, M. R., and Schmidt, J. W., "What Controls the Thickness of Wetting Layers," J. Chem. Soc. Farad. Trans. II 82, 1701 (1986).

Kheyrandish, K., Dalton, C., and Lienhard, J. H., "A Model of Fluid Flow During Saturated Boiling on a Horizontal Cylinder," J. Heat Transfer, 1986 (in press).

Kheyrandish, K. and Lienhard, J. H., "Mechanisms of Burnout in Saturated and Subcooled Flow Boiling over a Horizontal Cylinder," J. Heat Transfer, 1986 (submitted).

Koschmieder, E. L. and Biggerstaff, M. I., "Onset of Surface Tension Driven Benard Convection," J. Fluid Mech 167, 49-64 (1986).

Koster, J. N., "Interaction of Local Instabilities during Oscillatory Convection," Phys. Rev. Ann., 1988 (in press).

- Krantz, W. B. and Nerad, B. A., "A New Mechanism for Inducing Spontaneous Convection during Materials Processing in Low-g Fields," in *Science and Technology Series*, Volume 67 (J.N. Koster, ed.), AAS, 1987.
- Krantz, W. B. and Nerad, B. A., "Interrelationships between the Marangoni, Thin Film and Gradient-Driven Instability Mechanisms: The Thin Film Problem," in *Proceedings of the 1987 ASME/USME Thermal Engineering Joint Conference*, Volume 2 (P.J. Marto and I. Tanssawa, eds.), ASME, 1987.
- Lai, C. L., Ostrach, S., and Kamotani, Y., "The Role of Free-Surface Deformation in Unsteady Thermocapillary Flow," in *Proceedings of U.S.-Japan Heat Transfer Joint Seminar*, San Diego, 1985 (in press).
- Lai, C. L. and Chai, A-T., "Surface Temperature Distribution Along a Thin Liquid Layer due to Thermcapillary Convection," in *Microgravity Material and Fluid Sciences*, Volume 13 (L. Napolitano, ed.), Pergamon, 1987.
- Lai, C. L., Breenberg, P. S., and Chai, A-T., "Experimental Study of Thermocapillary Flows in a Thin Liquid Layer with Heat Fluxes Imposed on the Free Surface," NASA TM 100252, 1988.
- Lee, C. P. and Wang, T. G., "The Acoustic Radiation Force on a Heated (or Cooled) Rigid Sphere..Theory," *J. Acoust. Soc. Am.* 75, 88 (1984).
- Lee, C. P., Lyell, M. J., and Wang, T. G., "Viscous Damping of the Oscillations of a Rotating Simple Drop," *Phys. Fluids* 28, 3187 (1985).
- Lee, C. P. and Wang, T. G., "A Theoretical Model for the Annular Jet Instability," *Phys. Fluids* 29, 2076 (1986).
- Lee, C. P. and Wang, T. G., "The Centering Dynamics of a Thin Liquid Shell in Capillary Oscillations," *J. Fluid Mech.*, 1987 (in press).
- Lee, C. P. and Wang, T. G., "Acoustic Radiation Force on a Heated Sphere Including Effects of Heat Transfer and Acoustic Streaming," *J. Acoust. Soc. Am.*, 1988 (in press).
- Lee, C. P. and Wang, T. G., "Acoustic Radiation Potential on a Small Sphere due to Two Orthogonal Standing Waves," *J. Acoust. Soc. Am.*, 1988 (accepted).
- McFadden, G. B. and Coriell, S. R., "The Effect of Fluid Flow due to the Crystal-Melt Density Change on the Growth of a Parabolic Isothermal Dendrite," *J. Cryst. Growth* 74, 507 (1986).
- McFadden, G. B. and Coriell, S. R., "Thermosolutal Convection during Directional Solidification. II. Flow Transitions," *Phys. Fluids* 30, 659 (1987).
- McFadden, G. B., Boisvert, R. F., and Coriell, S. R., "Nonplanar Interface Morphologies during Unidirectional Solidification of a Binary Alloy, II. Three-Dimensional Computations," *J. Cryst. Growth* 84, 371-388 (1987).
- Meyer, J-L., Szekely, J., and El-Kaddah, N., "Calculation of the Electromagnetic Force Field for Induction Stirring in Continuous Casting," *Trans. Iron & Steel Inst. of Japan* 27, 25-33 (1987).

Meyer, J. L., El-Kaddah, N., Szekely, J., Vives, Ch., and Ricou, R., "A Comprehensive Study of the Induced Current, the Electromagnetic Force Field and the Velocity Field in a Complex Electromagnetically Driven Flow Systems," Trans. Met. 18B, 529-538 (1987).

Meyer, J. L., El-Kaddah, N., Szekely, J., Vives, Ch., and Ricou, R., "Electromagnetic and Fluid Flow Phenomena in a Mercury Model System of the Electromagnetic Casting of Aluminum," Met. Trans. 18B, 539-548 (1987).

Miller, T. L. and Fowlis, W. W., "Laboratory Experiments in a Baroclinic Annulus with Heating and Cooling on the Horizontal Boundaries," Geophys. and Astrophys. Fluid Dynam. 34, 283 (1986).

Moldover, M. R., "Opportunities for Low-Gravity Experiments in Critical Phenomena," in *Opportunities for Academic Research in a Low-Gravity Environment*, Volume 108 (G.A. Hazelrigg and J.M. Reynolds, eds.), AIAA, 1986, pp. 57-79.

Moldover, M. R. and Rainwater, J. C., "Interfacial Tension and Vapor-Liquid Equilibria in the Critical Region of Mixtures," J. Chem. Phys., accepted.

Murthy, A., Szekely, J., and El-Kaddah, N., "Experimental Measurement and Numerical Computation of Velocity and Turbulence Parameters in a Heated Liquid Metal System," Met. Trans. B, submitted.

Natarajan, R. and Brown, R. A., "Effect of Three-Dimensional Instabilities in the Break-up of Charged Drops," Proc. Roy. Soc. Lond. A410, 209-227 (1987).

Natarajan, R. and Brown, R. A., "Third Order Resonance Effects and the Nonlinear Stability of Drop Oscillations," J. Fluid Mech. 183, 95-121 (1987).

Patniak, S. and Brown, R. A., "Convection and Mass Transport in Laser-Induced Chemical Vapor Deposition," J. Electrochem. Soc., 1986 (submitted).

Runesson, K., Axelson, K., and Sture, S., "Assessment of a New Class of Implicit Integration Schemes for a Cone-cap Model," in *Proceedings of 6th International Conference for Numerical Methods in Geomechanics*, April 1988 (in press).

Roberts, G. O., Sutter, J. K., Fowlis, W. W., Radcliffe, M., and Drake, M. C., "Simulation of Fluid Flows During Growth of Organic Crystals in Microgravity," NASA TM-88921, 1987.

Sackinger, P. A. and Brown, R. A., "Effect of Sidewall Boundary Conditions on the Existence of Codimension Two Bifurcation Points in Two-dimensional Rayleigh-Benard Convection," Phys. Fluids, 1988 (submitted).

Sackinger, P., Brown, R. A., and McFadden, G. B., "Eigen-function Expansions for Determining Structure of Natural Convection in a Vertical Cylinder Heated from Below," J. Fluid Mech., 1988 (submitted).

Sani, R. L., Maslanik, M. K., and Fathi, Z., "Flow and Transport in Systems with Free and/or Moving Boundaries," in *Proceedings of International Conference on Computational Methods on Flow Analysis*, 1988 (in press).

Schmidt, J. W., "A Stabilized Vapor-Liquid Interface in Deuterate Cyclohexane-Methanol Mixtures," J. Chem. Phys., 3631 (1986).

- Schmidt, J. W., "Systematics of Wetting," J. Colloid & Interface Sci., in press.
- Schmidt, J. W., "Structure of a Fluid Interface near the Critical Point," Phys. Rev. A. Rapid Comm., accepted.
- Sheu, H. R., El-Aasser, M. S., and Vanderhoff, J. W., "Phase Domain Formation in Latex Interpenetrating Polystyrene Networks," Polym. Mat. Sci. Engr. **57**, 911 (1987).
- Squire, T. H., Shen, Y. H., Neitzel, G. P., and Jankowski, T. H., "Thermocapillary Convection in a Model Float-Zone," Phys. Rev., 1985 (accepted).
- Sudol, E. D., El-Aasser, M. S., and Vanderhoff, J. W., "Kinetics of Successive Seeding of Monodisperse Polystyrene Latexes. I. Initiation via Potassium Persulfate," J. Polym. Sci. Part A: Polym. Chem., 1986 (in press).
- Sudol, E. D., El-Aasser, M. S., and Vanderhoff, J. W., "Kinetics of Successive Seeding of Monodisperse Polystyrene Latexes II. AZO Initiators with and without Inhibitors," J. Polym. Sci. Part A: Polym. Chem., 1986 (in press).
- Takagi, Y. and Gammon, R. W., "Brillouin Scattering in Thin Samples--Observations of Backscattering Components by 90 Degrees Scattering," J. Appl. Phys. **61**, 2030 (1987).
- Trinh, E. H., Marston, P. L., and Robey, J. L., "Acoustic Measurement of the Surface Tension of Levitated Drops," J. Colloid & Interface Sci., 1988 (in press).
- Tsampoulous, J. A. and Brown, R. A., "Dynamic Centering of Liquid Shells," Phys. Fluids **30**, 27-35 (1987).
- Vanderhoff, J. W., El-Aasser, M. S., Micale, F. J., Sudol, E. D., Tseng, C. M., Sheu, H. R., and Kornfeld, D. M., "The First Products Made in Space: Monodisperse Latex Particles," Polymer Preprints **28**, 455 (1987).
- Vanderhoff, J. W., El-Aasser, M. S., Micale, F. J., Sudol, E. D., Tseng, C. M., Sheu, H. R., and Kornfeld, D. M., "The First Products Made in Space: Monodisperse Latex Particles," Mat. Res. Soc. Symp. Proc. **87**, 213 (1987).
- Voorhees, P. W., McFadden, G. B., Boisvert, R. F., and Meison, D. I., "Numerical Simulation of Morphological Development during Ostwald Ripening," Acta Metall. **36**, 207-222 (1988).
- Wang, S. and Meyer, H., "Transport Properties of Helium near the Liquid-Vapor Critical Point V. The Shear Viscosity of  $^3\text{He}$ - $^4\text{He}$  Mixtures," J. Low Temp. Phys. **69** (1987).
- Worden, P. W., "Almost Exactly Zero: The Equivalence Principle," Near Zero, 1986 (in press).
- Young, G. W., Davis, S. H., and Brattkus, K., "Anisotropic Interface Kinetics and Tilted Cells in Unidirectional Solidification," J. Cryst. Growth **83**, 560-571 (1987).
- Yung, C. N., De Witt, K. J., Brockwell, J. L., and Chai, C-T., "Factors Affecting the Rate of Bubble Dissolution," J. Colloid & Interface Sci., 1988 (accepted).

## Biotechnology

- Babu, Y. S., Bugg, C. E., and Cook, W. J., "Crystal Structure of Calmodium," in *Calcium Binding Proteins 1986: Proceedings of Fifth International Symposium on Calcium Binding Proteins in Health and Disease*, 1987 (in press).
- Babu, Y. S., Bugg, C. E., and Cook, W. J., "Three-dimensional Structure of Calmodulin," in *Molecular Aspects of Cellular Regulation*, Volume 5, 1987 (in press).
- Babu, Y. S., Bugg, C. E., and Cook, W. J., "X-ray Diffraction Studies of Calmodulin," *Methods in Enzymology* 139, 632-642 (1987).
- Baird, J. K., Meehan, E. J., Xidis, A. I., and Howard, S. B., "Convective Diffusion in Protein Crystal Growth," *J. Cryst. Growth* 76, 694 (1986).
- Baird, J. K., Frieden, R. W., Meehan, E. J., Twigg, P. J., Howard, S. B., and Fowles, W. W., "Evaporation Kinetics in the Hanging Drop Method of Protein Crystal Growth," *Mat. Res. Soc. Symp. Proc.* 87, 231 (1987).
- Baird, J. K., Frieden, R. W., Meehan, E. J., Twigg, P. J., Howard, S. B., and Fowles, W. W., "Model for Determining Vapor Equilibration Rates in the Hanging Drop Method for Protein Crystal Growth," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1986, pp. 391-394.
- Bamberger, S. B., Van Alstine, J. M., Baird, J. M., Harris, J. M., and Brooks, D. E., "Demixing of Aqueous Polymer Two-Phase Systems in the Absence of Gravity," *Sep. Sci. Tech.* 23, 17-34 (1988).
- Bier, M., Egen, N. B., Twitty, G. E., Mosher, R. A., and Thormann, W., "Preparative Electrophoresis Comes of Age," in *Chemical Separations*, Volume I, Principles (C.J. King and J.D. Navratil, eds.), 1986.
- Bixler, J. W., Bond, A. M., Lay, P. A., Thormann, W., van den Bosch, P., Fleischmann, M., and Pons, B. S., "Instrumental Configurations and Electrode Design for Voltammetry in Very Dilute Solutions Employing Carbon, Gold and Platinum Microdisk Electrodes in Static and Flow Through Cells," *Anal. Chim. Acta* 187, 67-77 (1986).
- Bond, A. M., Henderson, T.L.E., Mann, T. F., Mann, D. R., Thormann, W., and Zoski, C. G., "A Fast Electron Transfer Rate for the Oxidation of Ferrocene in Acetonitrile and Dichloromethane at Ultramicroelectrodes," *Anal. Chem.*, submitted.
- Brooks, D. E., Bamberger, S. B., Harris, J. M., Van Alstine, J. M., and Snyder, R. S., "Demixing Kinetics of Phase Separated Polymer Solutions in Microgravity," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 131-138.
- Brooks, D. E., "Cell Partitioning in Two Polymer Phase Systems: Towards Higher Resolution Separations," in *Frontiers in Bioprocessing* (M. Bier, S.K. Sikdar, and P. Todd, eds.), CRC Press, 1988 (in press).

Bugg, C. E., "The Future of Protein Crystal Growth," J. Cryst. Growth 76, 535 (1986).

Cardello, R. J., Broussard, M. R., and San, K-Y., "Development of an Expert System Based Bioreactor Control Scheme," in *Proceedings of Bioprocess Engineering Colloquium* (R.C. Dean, R.M. Nerem, eds.), ASME, 1987, pp. 21-24.

Cardello, R. J. and San, K-Y., "The Design of Controllers for Batch Bioreactors," Biotech. Bioengr., 1988 (in press).

Carson, M. and Bugg, C. E., "An Algorithm for Ribbon Models of Protein," J. Molec. Graph., 1985 (in press).

Curreri, P. A., Van Alstine, J. M., Brooks, D. E., Bamberger, S., and Snyder, R. S., "On the Stability of High Volume Fraction Immiscible Dispersions in Low Gravity," Met. Trans., 1985 (submitted).

Cherry, R. S. and Papoutsakis, E. T., "Physical Mechanisms of Cell Damage in Microcarrier Cell Culture Bioreactors," Biotechnol. Bioengr., in press.

Cherry, R. S. and Papoutsakis, E. T., "Modeling of Contact-Inhibited Animal Cell Growth on Flat Surface and Spheres," Biotechnol. Bioengr., 1987 (submitted).

Cherry, R. S. and Papoutsakis, E. T., "Growth and Death Rates of Bovine Embryonic Kidney Cells in Turbulent Microcarrier Bioreactors," Bioproc. Engr., 1988 (in press).

Damron, K. L., Barlow, G. H., Lewis, M. L., and Morrison, D. R., "Comparison of Fibrinolytic and Chromogenic Methods for Assay of Plasminogen Activators in Culture Medium from Kidney Cell Subpopulations," J. Fibrinolysis 2 (1987).

DeLucas, L. J., Suddath, F. L., Snyder, R. S., Naumann, R., Broom, M. B., Pusey, M., Yost, V., Herren, B., Carter, D., Nelson, B., Meehan, E., McPherson, A., and Bugg, C. E., "Preliminary Investigations of Protein Crystal Growth Using the Space Shuttle," J. Cryst. Growth 76, 681-693 (1986).

DeLucas, L. J., Suddath, F. L., Snyder, R. S., Naumann, R., Broom, M. B., Pusey, M., Yost, V., Herren, B., Carter, D., Nelson, B., Meehan, E., McPherson, A., and Bugg, C. E., "Protein Crystal Growth in Microgravity, in *Proceedings of Space: Biomedicine and Biotechnology Conference*, 1987, in press.

DeLucas, L. J., Greenhough, T. J., Rule, S. A., Myles, D. A., Babu, Y. S., Volanakis, J. E., and Bugg, C. E., "Preliminary X-ray Studies of Crystals of Human C-Reactive Protein," J. Mol. Biol. 196, 741-742 (1987).

DeLucas, L. J. and Bugg, C. E., "New Directions in Protein Crystal Growth," Trends in Biotechnology 5, 188-193 (1987).

Dintenfuss, L., "Execution of 'ARC' Experiment on Space Shuttle 'Discovery' STS 51-C: Some Results on Aggregation of Red Blood Cells under Zero Gravity," Biorheology 23, 331-347 (1986).

Dintenfass, L., "Speculations on Depletion of the Red Cell Mass in Astronauts, and on Space Sickness," Clinical Hemorheology **6**, 435-437 (1986).

Dintenfass, L., Osman, P., Maguire, B., and Jedrzejczyk, H., "Experiment on Aggregation of Red Cells under Microgravity on STS 51-C," Adv. Space Res. **6** (5), 81-84 (1986).

Dunning, J. D., Herren, B. J., Omenyi, S., Seaman, G.V.F., and Snyder, R. S., "Electrophoretic Separation and Characterization of Geologic Materials," Int. J. Min. Process., 1985 (submitted).

Ealick, S. E. and Bugg, C. E., "X-ray Crystallography," in The Bile Acids, Volume 4 (K.D.R. Setchell, ed.), Academic Press, 1987 (in press).

Egen, N. B., Twitty, G. E., Thormann, W., and Bier, M., "Fluid Stabilization during Isoelectric Focusing in Cylindrical and Annular Columns," Sep. Sci. & Tech. **22**, 1383-1403 (1987).

Farrington, M. and Hymer, W. C., "Development of an Enzyme Immunoassay for Rat Growth Hormone," Life Science **40**, 2479-2488 (1987).

Firestone, M. A., Michaud, J-P., Carter, R. H., and Thormann, W., "Capillary Zone Electrophoresis and Isotachopheresis as Alternatives to Chromatographic Methods for Purity Control of Synthetic Peptides," J. Chromato. **407**, 363-368 (1987).

Fowles, W. W., DeLucas, L. J., Twigg, P. J., Howard, S. B., Meehan, E. J., and Baird, J. K., "Experimental and Theoretical Analysis of the Rate of Solvent Equilibration in the Hanging Drop Method of Protein Crystal Growth," J. Cryst. Growth, 1988 (in press).

Goochee, C. F. and Passini, C. A., "Intracellular Proteins Produced by Mammalian Cells in Response to Environmental Stress," Biotechnology Progress, 1988 (submitted).

Gregory-Dwyer, V. M., Egen, N. B., Bianchi Bosisio, A., Righetti, P. G., and Russell, F. E., "A Study of Seasonal Variation in Rattlesnake Venom Proteins by Isoelectric Focusing," Toxicon **24**, 995-1000 (1986).

Grindeland, R., Hymer, W. C., Farrington, M., Fast, T., Hayes, C., Motter, K., Patil, L., and Vasques, M., "Changes in Pituitary Growth Hormone Cells Prepared from Rats Flown on Spacelab 3," Am. J. Physiol. **252**, 209-215 (1987).

Hamilton, R. G., Roebber, M., Reimer, C. B., and Rodkey, L. S., "Isoelectric Focusing-affinity Immunoblot Analysis of Mouse Monoclonal Antibodies to the Four Human IgG Subclasses," Electrophoresis **8**, 127-134 (1987).

Hamilton, R. G., Roebber, M., Reimer, C. B., and Rodkey, L. S., "Quality Control of Murine Monoclonal Antibodies using Isoelectric Focusing Affinity Immunoblot Analysis," Hybridoma **6**, 205-217 (1987).

Harris, J. M., Brooks, D. E., Boyce, J. F., Snyder, R. S., and Van Alstine, J. M., "Hydrophilic Polymer Coatings for Control of Electroosmosis and Wetting," in Dynamic Aspects of Polymer Surfaces (J.D. Andrade, ed.), Plenum Press, 1988, pp. 111-118.

- Harris, J. M., Hovanes, B. A., Yoshinaga, K., Snyder, R. S., Van Alstine, J. M., Karr, L. J., Bamberger, S. B., Boyce, J. F., and Brooks, D. E., "Purification of Biological Materials by Phase Partitioning," Polymer Preprints **28**, 465 (1987).
- Herren, B. J., Shafer, S. C., Van Alstine, J. M., Harris, J. M., and Snyder, R. S., "Control of Electroosmosis in Coated Quartz Capillaries," J. Colloid & Interface Sci. **115**, 46-55 (1987).
- Howland, D. D., Farrington, M., Taylor, W., and Hymer, W. C., "Alternative Splicing Model for the Synthesis and Secretion for the 20 Kilodalton form of Rat Growth Hormone," Biochem. Biophys. Res. Commun. **147**, 650-657 (1987).
- Hymer, W. C., Barlow, G. H., Blaisdell, S. J., Cleveland, C., Farrington, M., Feldmeier, M., Grindeland, R., Hatfield, J. M., Lanham, J. W., Lewis, M. L., Morrison, D. R., Olack, B. J., Richman, D. W., Rose, J., Scharp, D. W., Snyder, R. S., Swanson, C. A., Todd, P., and Wilfinger, W., "Continuous Flow Electrophoretic Separation of Proteins and Cells from Mammalian Tissues," Cell Biophysics **10**, 61-85 (1987).
- Jacobson, M. S., Kevy, S. V., Ausprunk, D., Button, L. N., Kim, B., Chao, F. C., and Surgenor, D. M., "A Unique Thin Film Technique for Platelet Storage," Blood **66**, 1004 (1985).
- Kendall, M. and Hymer, W. C., "Cell Blotting: A New Method for Quantifying Hormone Release from Single Rat Pituitary Cells," Endocrinology **12**, 2260-2262 (1987).
- Kim, B. S., Chao, F. C., Shapiro, H. M., Kenney, D. M., Surgenor, D. M., Jacobson, M. S., Button, L. N., and Kevy, S. V., "Membrane Potential in Stored Platelets," Blood **68**, 299 (1986).
- Knisley, K. and Rodkey, L. S., "Affinity Immunoblotting: High Resolution Isoelectric Focusing Analysis of Antibody Clonotype Distribution," J. Immuno. Meth. **95**, 79-87 (1986).
- Knisley, K. A. and Rodkey, L. S., "Isoelectric Focusing Analysis of Antibody Clonotype Changes Occurring during Immune Responses using Immobilized pH Gradients," Electrophoresis **9**, 183-186 (1988).
- Kuhn, R., Wagner, H., Mosher, R. A., and Thormann, W., "Experimental and Theoretical Investigation of the Stability of Stepwise pH Gradients in Continuous Flow Electrophoresis," in Electrophoresis **8**, 503-508 (1987).
- Lionetti, F. J., "Granulocytes at Microgravity," Abstract, *American Society of Gravitational and Space Biology Meeting*, October 1987.
- Mosher, R. A. and Thormann, W., "The Condensation of Ampholytes in Steady State Moving Boundaries: Analysis by Computer Simulation," Electrophoresis **7**, 395-400 (1986).
- Mosher, R. A., Thormann, W., and Bier, M., "An Explanation for the Plateau Phenomenon in Isoelectric Focusing," J. Chromato. **351**, 31-38 (1986).
- Mosher, R. A., Thormann, W., Egen, N., Couasnon, P., and Sammons, D., "Recent Advances in Preparative Electrophoresis," in *New Directions in Electrophoretic Methods*, Chapter 16 (M. Phillips and J. Jorgenson, eds.), ACS, 1987.

- Mosher, R. A., Egen, N. B., and Bier, M., "Recycling Instrumentation for Preparative Scale Electrophoresis," in *Protein Purification: Micro to Macro* (R. Burgess, ed.), Alan Liss Inc., 1987
- Paley, M. S. and Harris, J. M., "Synthesis of the Aldehyde of Oligomeric Polyoxyethylene," *J. Polym. Sci. Polym. Chem. Edn.* **25**, 2447-2454 (1987).
- Plank, L. D., Kunze, M. E., and Todd, P., "Electrophoretic Migration of Animal Cells in Vertical Ficoll Gradient, Theory and Experiment," *J. Biochem. Biophys. Meth.*, 1988 (submitted).
- Plank, L. D., Kunze, M. E., Gaines, R. A., and Todd, P., "Density Gradient Electrophoresis of Cell in a Reversible Gel," *Electrophoresis*, 1988 (submitted).
- Rhodes, P. and Snyder, R. S., "Sample Band Spreading Phenomena in Ground- and Space-Based Electrophoretic Separators," *Electrophoresis*, 1986 (in press).
- Rhim, W. K., Hyson, M. T., Chung, S. K., Colvin, M., and Chang, M., "Containerless Polymeric Microsphere Production for Biomedical Applications," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, p. 225.
- Rodkey, L. S. and Hirata, A., "Studies of Ampholyte-Protein Interactions," in *Protides of Biological Fluids*, Volume 34, Pergamon Press, 1986, pp. 745-748.
- Rodkey, L. S., "Ionic Binding Properties of Carrier Ampholytes," *J. Chromato.* **437**, 147-159 (1988).
- Sammons, D. W. and Adams, L., "Color Silver Staining of Polypeptides in Polyacrylamide Gels," in *New Directions in Electrophoretic Methods*, Chapter 6 (J.W. Jorgenson and M. Phillips, eds.), ACS, 1987, pp. 91-101.
- Seferian, P. G., Rodkey, L. S., and Adler, F. L., "Selective Survival and Expression of B-lymphocyte Memory Cells during Long Term Serial Transplantation," *Cellular Immunol.* **110**, 226-232 (1987).
- Sharp, K. A., Brooks, D. E., Van Alstine, J. M., and Bamberger, S., "Mechanisms of Cell Partition in Aqueous Polymer Two Phase Systems," *Biophys. J.*, 1985 (submitted).
- Sloan, J. E., Thormann, W., Bier, M., Twitty, G. E., and Mosher, R. A., "Recycling Isotachopheresis: A Novel Approach to Preparative Protein Fractionation," in *Electrophoresis '86* (M.J. Dunn, ed.), VCH, 1986, pp. 696-699.
- Surgenor, D. M., "Blood Formed Elements in Microgravity," *Blood* **68** (1986).
- Surgenor, D. M., Ausprunk, D., Blevins, D., Chao, F. C., Curby, W., Jacobson, M., Kenney, D. M., Kevy, S. V., Kim, B., Laird, N., and Szymanski, I., "Human Blood Platelets at Microgravity," Abstract, *38th International Astronautical Federation (IAF) Congress*, October 1987.
- Thormann, W., Michaud, J-P., and Mosher, R. A., "Theoretical and Experimental Separation Dynamics in Capillary Zone Electrophoresis," in *Electrophoresis '86* (M.J. Dunn, ed.), VCH, 1986, pp. 267-270.

- Thormann, W., Mosher, R. A., and Bier, M., "Separations by Capillary Electrophoresis," in *Chemical Separations*, Volume 1, *Principles* (C.J. King and J.D. Navratil, eds.), 1986.
- Thormann, W., Tsai, A., Michaud, J-P., Mosher, R. A., and Bier, M., "Effects of Capillary Geometry, Voltage Gradient and Addition of Linear Polymer," *J. Chromato.* 389, 75-86 (1987).
- Todd, P., "Applications of Free Flow Electrophoresis in Orbital Space Flight," in *Electrophoresis '86* (M.J. Dunn, ed.), VCH, 1986, pp. 3-12.
- Todd, P., Plank, L. D., Kunze, M. E., Lewis, M. L., Morrison, and D. R., Barlow, G. H., "Electrophoretic Separation and Analysis of Living Cells from Solid Tissues by Several Methods," *J. Chromato.* 364, 11-24 (1986).
- Todd, P., "The Evolving Microlesion Concept," *Adv. Space Res.* 6, 187-189 (1987).
- Todd, P., Kurdyla, J., Sarnoff, B. E., and El Aasser, W., "Analytical Cell Electrophoresis as a Tool in Preparative Cell Electrophoresis," in *Frontiers in Bioprocessing* (S. Sikdar and P. Todd, eds.), CRC Press, 1987 (submitted).
- Tsai, A., Mosher, R. A., and Bier, M., "Computer Simulation of Two Electrophoretic Columns Coupled for Isoelectric Focusing in Simple Buffers," *Electrophoresis* 7, 487-491 (1986).
- Van Alstine, J. M., Sorrenson, P. B., Webber, T. J., Grieg, R. G., Poste, G., and Brooks, D. E., "Heterogeneity in the Surface Properties of B16 Melanoma Cells From Sublines with Differing Metastatic Potential Detected via Two Polymer Aqueous Phase Partition," *Expt'l. Cell Res.* 164, 366 (1986).
- Van Alstine, J. M., Trust, T. J., and Brooks, D. E., "Differential Partition of 'Aeromonas salmonicida' and Attenuated Derivatives Possessing Specific Cell Surface Alterations in Two Polymer Aqueous Phase Systems," *Appl. & Environ. Microbiol.* 51, 1309 (1986).
- Van Alstine, J. M., Brooks, D. E., Sharp, K. A., Snyder, R. S., Karr, L. J., and Harris, J. M., "Novel Uses of Polymer Phase Partition Affinity Ligands," in *Proceedings of 5th International Conference on Partition in Aqueous Phase Systems* (D. Fisher and I. Sutherland, eds.), Plenum Press, 1988.
- Van Alstine, J. M., Karr, L. J., Harris, J. M., Snyder, R. S., Bamberger, S. B., Matsos, H. C., Curreri, P. A., Boyce, J., and Brooks, D. E., "Phase Partitioning in Space and on Earth," in *Immunobiology of Proteins and Peptides IV* (M.Z. Atassi, ed.), Plenum, 1988 (in press).
- Vijay-Kumar, S., Bugg, C. E., and Cook, W. J., "Three-dimensional Structure of Ubiquitin at 1.8 Å Resolution," *J. Mol. Biol.* 194, 531-544 (1987).
- Vijay-Kumar, S., Ealick, S. E., Nagabhushan, S. E., Tattanahalli, L., Trotta, P. P., Kosecki, R., Reichart, P., and Bugg, C. E., "Crystallization and Preliminary X-ray Investigation of a Recombinant Form of Human Gamma Interferon," *J. Biol. Chem.* 262, 4804-4805 (1987).
- Vijay-Kumar, S., Bugg, C. E., Wilkinson, K. D., Vierstra, R. D., Hatfield, P. M., and Cook, W. J., "Comparison of the Three-dimensional Structures of Human, Yeast and Oat Ubiquitin," *J. Biol. Chem.* 262, 6396-6399 (1987).

Yoshinaga, K., Shafer, S. G., and Harris, J. M., "Effects of Polyethylene Glycol Substitution on Enzyme Activity," J. Bioact. Compatible Polym. 2, 49-56 (1987).

Zukoski, C. F. and Saville, D. A., "The Interpretation of Electrokinetic Measurements Using a Dynamic Model of the Stern Layer, I. The Dynamic Model," J. Colloid & Interface Sci. 114, 32-44 (1985).

Zukoski, C. F. and Saville, D. A., "The Interpretation of Electrokinetic Measurements Using a Dynamic Model of the Stern Layer. II. Comparisons Between Theory and Experiment," J. Colloid & Interface Sci. 114, 45-53 (1985).

Zukoski, C. F. and Saville, D. A., "Electrokinetic Properties of Particles in Concentrated Suspensions," J. Colloid & Interface Sci. 115, 422-436 (1987).

## Glasses and Ceramics

- Barmatz, M., "Orienting Acoustically-Levitated Aspherical Objects," NASA Tech Briefs, NPO 16846, 1988.
- Bahrami, P. A. and Wang, T. G., "Analysis of Gravity and Conduction Driven Melting in a Sphere," J. Heat Transf., 1988 (submitted).
- Chakraborty, I. N., Rutz, H., and Day, D. E., "Glass Formation, Properties and Structure of  $Y_2O_3-Al_2O_3-B_2O_3$  System," J. Non-cryst. Solids **81**, 173 (1986).
- Collas, P. and Barmatz, M., "Acoustic Radiation Force on a Particle in a Temperature Gradient," J. Acoust. Soc. Am. **81**, 1327-1330 (1987).
- Day, D. E. and Ray, C. S., "Research on Containerless Melts in Space," in *Opportunities for Research in a Low-Gravity Environment*, Chapter 6A (G.A. Hazelrigg and J.M. Reynolds, eds.), AIAA, 1986, pp. 165-192.
- Day, D. E. and Ray, C. S., "Containerless Processing of Glass Forming Melts in Space, MEA/A-2 Experiment," Final Report, NAS8-34758, 1986.
- Devaud, G. and Turnbull, D., "Undercooling of Liquid Germanium," in *Proceedings of Materials Research Society* **57**, 1986 (in press).
- Doremus, R. H. and Nordine, P. C. (eds.), *Materials Processing in the Reduced Gravity Environment of Space*, MRS, 1987.
- Ethridge, E. C., Curreri, P. A., and Pline, D., "Heterogeneous-Nucleation and Glass-Formation Studies of  $56Ga_2O_3-44CaO$  Systems," J. Am. Ceram. Soc. **70**, 553 (1987).
- Huang, W., Ray, C. S., and Day, D. E., "Dependence of the Critical Cooling Rate for Lithium-Silicate Glass on Nucleating Agents," J. Non-cryst. Solids **86**, 204 (1986).
- Kim, H. S. and Subramanian, R. S., "The Thermocapillary Migration of a Droplet with Insoluble Surfactant. Part I: Surfactant Cap," J. Colloid & Interface Sci., 1988 (in press).
- Kondo, P., Subramanian, R. S., and Weinberg, M. C., "The Dissolution or Growth of a Gas Bubble Inside a Drop in Zero Gravity," in *Materials Research Society Symposia Proceedings Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 261-269.
- Lee, C. P. and Wang, T. G., "The Centering Dynamics of a Thin Liquid Shell in Capillary Oscillations," J. Fluid Mech., 1988 (in press).
- Lee, C. P. and Wang, T. G., "Acoustic Radiation Force on a Heated Sphere Including Effects of Heat Transfer and Acoustic Streaming," J. Acoust. Soc. Am., 1988 (in press).
- Lee, C. P. and Wang, T. G., "Acoustic Radiation Potential on a Small Sphere due to Two Orthogonal Standing Waves," J. Acoust. Soc. Am., 1988 (accepted).
- Lee, C. P. and Wang, T. G., "Near Boundary Streaming Around a Small Sphere due to Two Orthogonal Standing Waves," J. Acoust. Soc. Am., 1988 (accepted).

- Mathew, J. and Doremus, R. H., "Outgassing of  $ZrF_4$ -Based Glasses," J. Am. Ceram. Soc. **70**, C-86 (1987).
- Merritt, R. M. and Subramanian, R. S., "The Migration of Isolated Gas Bubbles in a Vertical Temperature Gradient," J. Colloid & Interface Sci., 1988 (in press).
- Meyyappan, M. and Subramanian, R. S., "Thermocapillary Migration of a Gas Bubble in an Arbitrary Direction with Respect to a Plane Surface," J. Colloid & Interface Sci. **115**, 206-219 (1987).
- Nordine, P. C., "The Accuracy of Multi-Color Optical Pyrometry," High Temp. Sci., 1985 (accepted).
- Ray, C. S. and Day, D. E., "Crystallization of  $2Bi_2O_3 \cdot 3GeO_2$  Glass," in *Proceedings of 15th Annual Meeting of North American Thermal Analysis Society*, 1986, pp. 353-358.
- Ray, C. S. and Day, D. E., "Glass Formation in Microgravity," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 239-251.
- Ray, C. S., Huang, W., and Day, D. E., "Crystallization of Lithia-Silica Glasses: Effects of Composition and Nucleating Agent," J. Am. Ceram. Soc. **70**, 599 (1987).
- Ray, C. S., Huang, W., and Day, D. E., "Crystallization Kinetics of Lithia-Silica Glass: Effect of Sample Characteristics and Measurements Techniques," J. Am. Ceram. Soc., 1987 (in press).
- Ruggles, J. S., Cook, R. G., Annamalai, P., and Cole, R., "Bubble and Drop Trajectories in Rotating Flows," in *Experimental Thermal and Fluid Science*, 1988 (in press).
- Schilling, C. H. and Lee, M. C., "PbO Reduction and Crucible Reactions of 70 wt% PbO 30 wt%  $B_2O_3$  Glass," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 253-260.
- Shankar, N. and Subramanian, R. S., "The Stokes Motion of a Gas Bubble due to Interfacial Tension Gradients at Low to Moderate Marangoni Numbers," J. Colloid & Interface Sci. **123**, 512 (1988).
- Smith, G. L., Neilson, G. F., and Weinberg, M. C., "Crystal Nucleation in Lithium Borate Glass," Phys. Chem. Glasses **28**, 257 (1987).
- Subramanian, R. S., "The Behavior of Multiphase Systems in Low Gravity," in Low Gravity Sciences (J.N. Koster, ed.), AAS, 1987.
- Uhlmann, D. R., Weinberg, M. C., and Teowee, G., "Crystallization of Gel-Derived Glass," J. Non-cryst. Solids, in press.
- Weinberg, M. C., "Physical Data Measurements and Mathematical Modelling of Simple Gas Bubble Experiments in Glasmelts," J. Noncryst. Solids **84**, 159 (1986).
- Weinberg, M. C., "On the Possibility of Diffusionally Driven Oscillations in Two Component Gas Bubbles," Chem. Engr. Sci. **41**, 2333 (1986).

Weinberg, M. C., "A Test of the Johnson-Mehl-Avami Equations," J. Cryst. Growth **82**, 779 (1987).

Weinberg, M. C., "Combined Homogeneous and Heterogeneous Crystal Nucleation in Glass," J. Am. Ceram. Soc. **70**, 475 (1987).

Weinberg, M. C. and Neilson, G. F., "A Comparison of the Phase Transformation Behavior of Gel-Derived and Ordinary  $\text{Na}_2\text{O-SiO}_2$  Glasses," in Sol-Gel Technology (L. Klein, ed.), 1988 (in press).

Weinberg, M. C., Smith, G. L., and Neilson, G. F., "Glass Formation and Crystallization of High Lead Content  $\text{PbO-B}_2\text{O}_3$  Compositions," Bull. Am. Ceram. Soc. **65**, 1502 (1986).

Zanotto, E. D. and Weinberg, M. C., "Saturation Effects in Homogeneous and Heterogeneous Nucleation," J. Non-cryst. Solids, 1988 (submitted).

## Combustion Science

- Abramzon, B., Edwards, D. K., and Sirignano, W. A., "Transient, Stratified, Enclosed Gas and Liquid Behavior with Concentrated Heating from Above," J. Thermophys. & Heat Transf. **1**, 355 (1987).
- Aggarwal, S. K., Iyengar, J., and Sirignano, W. A., "Enclosed Gas and Liquid with Nonuniform Heating from Above," Int. J. Heat Mass Transfer, 1593-1604 (1986).
- Altenkirch, R. A., "Combustion Studies in Microgravity," in *Progress in Astronautics and Aeronautics* **108**, 225-230 (1986).
- Altenkirch, R. A. and Vedha-Nayagam, M., "Opposed-Flow Flame Spread and Extinction in Mixed Convection Boundary Layers," in *Proceedings of Twenty-Second International Symposium on Combustion*. 1988 (submitted).
- Berlad, A. L., "Combustion Studies in Microgravity," in *Opportunities for Academic Research in a Low-Gravity Environment*, Volume 108 (G.A. Hazelrigg and J.M. Reynolds, eds.), AIAA, 1986, pp. 210-224.
- Berlad, A. L. and Tangirala, V. E., "Autoignition of Fuel Oxidizer Mixtures in Microgravity," Acta Astron., 1988 (in press).
- Curtis, E. W. and Farrell, P. V., "Droplet Vaporization in Supercritical Microgravity Environment," Acta Astron., 1987 (in press).
- Dosanjh, S. S., Peterson, J., Fernandez-Pello, A. C., and Pagni, P. J., "Buoyancy Effects on Smoldering Combustion," Acta Astron. **13**, 689-696 (1986).
- Dosanjh, S. S., Pagni, P. J., and Fernandez-Pello, A. C., "Forced Current Smoldering Combustion," in *Proceedings of Twenty-First International Symposium on Combustion*, Volume 1 (P.J. Marto and I. Tanasawa, eds.), 1987, pp. 165-173.
- Dosanjh, S. S., Pagni, P. J., and Fernandez-Pello, A. C., "Forced Cocurrent Smoldering Combustion," Comb. & Flame **68**, 131-142 (1987).
- Edelman, R. B. and Bahadori, M. Y., "Effects of Buoyancy on Gas Jet Diffusion Flames, Experiment and Theory," Acta Astron. **13**, 681-688 (1986).
- Hamins, A., Meitor, M., and Libby, P. A., "Gravitational Effects on the Structure and Propagation of Premixed Flames," Acta Astron., in press.
- Joshi, N. D. and Berlad, A. L., "Gravitational Effects on Stabilized Lycopodium-Air Flames," Comb. Sci. & Techn. **47**, 55 (1986).
- Kailasanath, K. and Oran, E. S., "Effect of Curvature and Dilution on Unsteady Flame Propagation, I. Flames and Configurations," Prog. Aero. & Astron. **105** (1986).
- Libby, P. A., "Theoretical Analysis of the Effect of Gravity on Premixed Turbulent Flames," Comb. Sci. & Techn., 1988 (in press).

Olson, S. L., "The Effect of Microgravity on Flame Spread over a Thin Fuel," NASA TM 100195, 1987.

Patnaik, G., Boris, J. P., Guirguis, R. H. and Oran, E. S., "A Barely Implicit Correction for Flux-Corrected Transport," J. Comput. Phys., 1987 (in press).

Shaw, B. D., Dryer, F. L., Williams, F. A., and Gat, N., "Interactions Between Gaseous Electrical Discharges and Single Liquid Droplets," Comb. & Flame, 1988 (in press).

Shaw, B. D., Dryer, F. L., Williams, F. A., and Haggard, J. B., "Sooting and Disruption in Spherical Symmetrical Combustion of Decane Droplets in Air," Acta Astron., 1988 (in press).

Strehlow, R. A., Noe, K. A., and Wherley, B. L., "The Effect of Gravity on Premixed Flame Propagation and Extinction in a Vertical Standard Flammability Tube," in *Proceedings of 21st International Symposium on Combustion*, Combustion Institute. 1985 (in press).

## Experimental Technology and Instrumentation

- Barmatz, M., "Acoustic Levitation with One Transducer," NASA Tech Briefs, NPO 16846, 1988.
- Bayuzick, R. J., Hofmeister, W. H., and Robinson, M. B., "Review on Drop Towers and Long Drop Tubes," in *Undercooled Alloy Phases* (E.W. Collings and C.C. Koch, eds.), TMS, 1987, pp. 207-232.
- Berg, R. F. and Moldover, M R., "Viscometer for Low Frequency, Low Shear Rate Measurements," Rev. Sci. Instrum. 57, 1667 (1986).
- Bond, A. M. Heritage, I. D., and Thormann, W., "A Strategy for Trace Metal Determination in Seawater by Anodic Stripping Voltammetry Using a Comperized Multi-time Domain Measurement Method," Anal. Chem. 58, 1063 (1987).
- El-Kaddah, N., Szekely, J., Taberlet, E., and Fautrelle, Y., "Turbulent Recirculating Flow in Induction Furnaces, A Comparison of Measurements with Predictions over a Range of Conditions," Met. Trans. 17B, 693 (1986).
- Ethridge, E. C. and Curreri, P. A., "Apparatus for Rapid Thermal Analyses Studies of Reluctant Glass Formers," Rev. Sci. Instrum. 59, 184 (1988).
- Gammon, R. W., "Photon Correlation Light Scattering Apparatus for the Space Shuttle," in *Proceedings of 19th International SAMPE Conference*, 1987 (in press).
- Kamotani, Y. and Ostrach, S., "Design of a Thermocapillary Flow Experiment in Reduced Gravity," J. Thermophys. & Heat Transf. 1, 83-89 (1987).
- Lee, M. C. and Allen, J. L., "Noncontact True Temperature Measurements," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 285-293.
- Leung, E., Lee, C. P., Jacobi, N., and Wang, T. G., "Resonance Frequency Shift of an Acoustic Chamber Containing a Rigid Sphere," J. Acoust. Soc. Am. 72, 615 (1982).
- Meyer, J-L., El-Kaddah, N., Szekely, J., A New Method for Computing Electromagnetic Force Fields in Induction Furnaces," MAG-23, 1806-1810 (1987).
- Owen, R. B., "Research in Materials Processing Using a Low Gravity Simulation Aircraft," in *Low-Gravity Science* (J.N. Koster, ed.), AAS, 1986.
- Rhim, W. K., Chung, S. K., Hyson, M. T., and Elleman, D. D., "Charged Drop Levitators and Their Applications," in *Materials Research Society Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 103-112.
- Rhim, W. K., Chung, S. K., Trinh, E. H., and Elleman, D. D., "Charged Drop Dynamics Experiment Using an Electrostatic-Acoustic Hybrid System," in *Materials Research Society Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 329-337.

- Rhim, W. K., Chung, S. K., Trinh, E., Hyson, M. T., and Elleman, D. D., "Large Charged Drop Levitation Against Gravity," IEEE Trans. Indust. Appl. **1A-23**, 975 (1987).
- Robey, J. L., Trinh, E. H., and Wang, T. G., "Acoustic Force Measurement in a Dual Temperature Resonant Chamber," J. Acoust. Soc. Am., 1988 (in press).
- Snyder, H. A., "Dewar to Dewar Model for Superfluid Helium Transfer," Cryogenics **28** (1988).
- Sudol, E. D., El-Aasser, M. S., and Micale, F. J., "Development and Testing of a Space Flight Dilatometer/ Reactor," Rev. Sci. Instrum., 1986 (in press).
- Thormann, W. and Bond, A. M., "Application of Transient Electrochemical Techniques to Inlaid Ultramicroelectrodes: Assessment of Fabrication Quality," J. Electrochem. Soc. **218**, 187-196 (1987).
- Trinh, E. H., "Acoustic Levitation Methods for Density Measurements," J. Acoust. Soc. Am. **80**, 1757 (1986).
- Trinh, E. H. and Olli, E. H., "Single Axis Acoustic Torque Generation and Control," NASA Tech Brief, NPO 17086, 1987.
- Wills, G. L., Urbach, A. R., Word, A. J., Brandreth, B. H., Hermanson, L. A., and Snyder, H. A., "Experiments on Transferring Helium II with a Thermomechanical Pump," Adv. Cryogenic Engr. **33** (1987).
- Witherow, W. K., "Reconstruction Techniques of Holograms from Spacelab 3," Appl. Opt., 1986 (submitted).

## General Studies and Surveys

Brown, R. A., "Numerical Analysis of Solidification Microstructure," in *Supercomputer Research in Chemistry and Chemical Engineering*, ACS Symposium Series Volume 353 (D.G. Truhlar and K.F. Jensen, eds.), ACS, 1987, pp. 295-333.

Debe, M. K., "Industrial Material Processing Experiments Onboard the Space Shuttle Orbiter," J. Vac. Sci. Techn., 1986 (in press).

Koster, J. N., "Working in Space: Present and Future," in *Aerospace Century XXI: Space Science, Applications and Commercial Developments*, Volume 64 (G.W. Morgenthaler, et al., eds.), AAS, 1987.

Morrison, D. R. and Todd, P., "Microgravity Sciences and Applications: An Overview of NASA's Program and Experiments in Microgravity Biotechnology," in *Microgravity Science and Applications*, NAS, 1986, pp. 168-196.

Radcliffe, M. D., Drake, C. M., Fowles, W. W., Alexander, J.I.D., Roberts, G. O., Sutter, J. K., and Bergman, E., "Fluid Flow in Low Earth Orbit," Polymer Preprints 27, 463-464 (1987).

Rindone, G., "A Down-to-Earth Look at Materials Processing Research in Space," Am. Ceram. Soc. Bull. 66, 1475 (1987).

Todd, P., "Bioprocessing in Space," in *Proceedings of Workshop on Space: Biomedicine and Biotechnology*, National Research Council of Canada, 1986, pp. 72-80.

Todd, P., "What Space Technology can offer Pharmaceutical Science," Pharmacy Int'l 7, 189-191 (1986).

Trinh, E. H., Robey, J., Gaspar, M., and Arce, A., "Experimental Studies in Fluid Mechanics and Materials Science Using Acoustic Levitation," in *Materials Research Society Symposia Proceedings, Materials Processing in the Reduced Gravity Environment of Space*, Volume 87 (R.H. Doremus and P.C. Nordine, eds.), MRS, 1987, pp. 57-69.

*Microgravity Materials Science Laboratory*, Laboratory Description and Scientist and Engineer's Application Procedures for its Use, NASA Lewis Research Center, June 1987.

## **B. EUROPEAN PROGRAM**



## Electronic Materials

Croll, A., Muller, W., and Nitsche, R., "Floating-Zone Growth of Surface-Coated Silicon under Microgravity," *J. Cryst. Growth* **79**, 65-70 (1986).

Croll, A., Muller, W., and Nitsche, R., "Dopant Distribution in Semiconductor Crystals under Microgravity," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 87-94.

Croll, A., Muller, W., and Nitsche, R., "Floating Zone Crystallization of Silicon," in *Proceedings of the Norderney Symposium on Scientific Results of the German Spacelab Mission D1* (P.R. Sahm, R. Jansen, and M.H. Keller, eds.), 1987, pp. 260-264.

Ratke, L. and Vogel, H. J., "Grain Boundary Grooving of Al-Bicrystals in the Presence of a Liquid Al-In Alloy," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 361-366.

## Metals, Alloys, and Composites

Herlach, D. M. and Feuerbacher, B., "Nucleation and Undercooling," in *Materials Sciences in Space* (B. Feuerbacher, H. Hamacher, and R.J. Naumann, eds.), Springer-Verlag, 1986, pp. 168-190.

Pant, P., "Fundamental Studies on the Manganese-Bismuth System in Microgravity," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 335-338.

Potschke, J., "On the Behavior of Foreign Particles at an Advancing Solid-Liquid Interface," J. Cryst. Growth, 1986 (submitted).

Ratke, L., "Simultaneous Coarsening of Dispersions by Growth and Coagulation," J. Colloid & Interface Sci., 1986 (submitted).

Ratke, L., Thieringer, W. K., and Fischmeister, H., "Coarsening of Immiscible Liquid Alloys by Ostwald Ripening," in *Proceedings of the Norderney Symposium on Scientific Results of German Spacelab Mission D-1*, 1987, pp. 332-342.

Sprenger, H. J., "Skin Technology - Directional Solidification of Multiphase Alloys," in *Proceedings of the Norderney Symposium on Scientific Results of German Spacelab Mission D-1*, 1987, pp. 342-349.

Thieringer, W. K., Ratke, L., and Fischmeister, H., "Ostwald Ripening of Liquid Al-Pb Dispersions," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 169-172.

Thieringer, W. K. and Ratke, L., "The Coarsening of Liquid Al-Pb Dispersions," Acta Metall. 35, 1237 (1987).

Willnecker, R., Herlach, D. M., and Feuerbacher, B., "Containerless Undercooling of Bulk FeNi Melts," Appl. Phys. Lett. 49, 1339-1341 (1986).

Willnecker, R., Herlach, D. M., and Feuerbacher, B., "Undercooling of Bulk Metals by Application of Electromagnetic Levitation Techniques," in *Proceedings of 6th European Symposium on Materials Sciences under Microgravity*, ESA SP-256, 1987, pp. 339-344.

## Fluid Dynamics and Transport Phenomena

- Bauer, H. F., "Coupled Frequencies of a Hydroelastic Viscous Liquid System," Int. J. Solids & Struct. **122**, 1471-1484 (1986).
- Bauer, H. F., "Surface and Interface Oscillations of a Rotating Visco-elastic Liquid Column of Immiscible Liquids," ZAMP **37**, 514-537 (1986).
- Bauer, H. F., "Coupled Frequencies of a Hydroelastic System Consisting of an Elastic Shell and Frictionless Liquid," J. Sound & Vibr. **113**, 217-232 (1987).
- Bauer, H. F., "Thermocapillary and Residual Natural Convection in an Orbiting Spherical Liquid System," Forsch. Ing. Wes. **53**, 83-93 (1987).
- Bauer, H. F., "Natural Frequencies and Stability of Immiscible Cylindrical z-Independent Liquid Systems," Appl. Micro. Techn. **1(1)**, 11-26 (1987).
- Bauer, H. F., "Natural Frequencies and Stability of Immiscible Spherical Liquid Systems," Appl. Micro. Techn. **1(2)**, 90-102 (1988).
- Bauer, H. F., "Natural Frequencies and Stability of Circular Cylindrical Immiscible Liquid Systems," Appl. Micro. Techn., 1988, (in press).
- Bauer, H. F., "Hydroelastic Oscillations of a Viscous Infinitely Long Liquid Column," J. Sound & Vibr., in press.
- Bauer, H. F. and Eidel, W., "Nonlinear Liquid Oscillations in Spherical Systems under Zero-Gravity," Acta Mech. **65**, 107-126 (1986).
- Bauer, H. F. and Eidel, W., "Induced Surface Oscillations due to Time-Oscillatory Temperature Distribution in a Viscoelastic Spherical System," Ing. Arch. **57**, 209-222 (1987).
- Bauer, H. F. and Eidel, W., "Marangoni Convection in a Spherical Liquid System," Acta Astron., in press.
- Bauer, H. F. and Eidel, W., "Vibration of a Visco-elastic Spherical Immiscible Liquid System," ZAMM, in press.
- Ben Hadid, H., Roux, B., Randriamanpianina, A., Crespo, E., and Bontoux, P., "Onset of Oscillatory Convection in Horizontal Layers of Low Prandtl Number Melt," in NATO-ASI Series (M.G. Velarde, ed.), Plenum Press, 1987.
- Beysens, D., Guenoun, P., and Perrot, F., "Phase Separation in Microgravity of Binary Fluids near a Critical Point," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 139-144.
- Beysens, D., "Critical Phenomena," in *Materials Sciences in Space* (B. Feuerbacher, H. Hamacher, and R.J. Naumann, eds.), Springer-Verlag, 1986, pp. 191-224.
- Beysens, D., Straub, J., and Turner, D. J., "Phase Transitions and Near Critical Point Phenomena," in *Fluid Sciences and Material Science in Space* (H. Walter, ed.), Springer-Verlag, 1987, pp. 221-256.

- Beysens, D., Guenoun, P., and Perrot, F., "Phase Separation of Critical Binary Fluids under Microgravity: Comparison with Matched Density Conditions," *Phys. Rev. A*, in press.
- Bisch, C. and Lasek, A., "Experiences sur la Coalescence des Goutees en Microgravite Simulee," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 209-214.
- Bontoux, P., Smutek, C., Roux, B., and Lacroix, J. M., "3D Buoyancy-Driven in Cylindrical Cavities with Differentially Heated End Walls. Part I: Horizontal Cylinders," *J. Fluid Mech.* **169**, 211-227 (1986).
- Bontoux, P., Smutek, C., Roux, B., Extremet, G. P., Schiroky, G. H., Hurford, A. C., and Rosenberger, F., "Finite Difference Solutions for Three-Dimensional Buoyancy Driven Flows in Inclined Cylinders," in *Numerical Methods for Non Linear Problems*, Volume 3 (Taylor, et al., eds.), 1986, pp. 1102-1115.
- Bontoux, P., Smutek, C., Randriamampianina, A., Roux, B., Extremet, G. P., Hurford, A. C., Rosenberger, F., and DeVahl Davis, G., "Numerical Solutions and Experimental Results of Three-dimensional Buoyancy Driven Flows in Tilted Cylinders," *Adv. Space Res.* **6(5)**, 155-160 (1986).
- Bontoux, P., Elie, F., Smutek, C., Extremet, G. P., Randriamampianina, A., Crespo, E., Branger, H., and Roux, B., "Numerical Simulations of Buoyancy Driven Flows in Cylinders and Cavities for Vapour Crystal Growth," in *NATO Series* (M.G. Velarde, ed.), Plenum Press, 1987.
- Chun, C-H., "Thermocapillary Flow in Surroundings of a Bubble under a Heated Wall," in *Proceedings of the 15th International Symposium on Space Technology and Science*, Tokyo, 1986, pp. 2127-2136.
- Chun, C-H., Ehmann, M., Siekmann, J., and Wozniak, G., "Vibrations of Rotating Menciisci," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 229-234.
- Crespo, E., Bontoux, P., Smutek, C., Roux, B., Hardin, G., Sani, R., and Rosenberger, F., "Three-Dimensional Simulation of Convection Regimes in Cylindrical Ampoules. Comparisons with Theoretical Analysis and Experiments," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 529-537.
- Durr, H. M. and Siekmann, J., "Numerical Studies of Fluid Oscillation Problems by Boundary Integral Techniques," *Acta Astron.*, 1986 (in press).
- Eidel, W., "Freie und Erzwungene Nichtlineare Schwingungen eines Reibungsfreien Flussigkeitstrofens unter Schwerelosigkeit," *Ing. Arch.* **56**, 1986 (in press).
- Elie, F., Randriamampianina, A., Bontoux, P., Extremet, G. P., and Roux, B., "Numerical Modelling of Physical Vapour Transport in Rectangular Enclosures," in *Numerical Methods for Non Linear Problems*, Volume 3 (Taylor, Owen, Hinton, and Damjanic, eds.), 1986, pp. 738-753.

Extremet, G. P., Roux, B., and Bontoux, P., "Numerical Model for Thermal and Solutal Convection and Multizone Physical Vapour Transport," Adv. Space Res. **6(5)**, 147-153 (1986).

Extremet, G. P., Bontoux, P., and Roux, B., "Effects of Temperature Gradient Locally Applied on a Long Horizontal Cavity," Int. J. Heat and Fluid Flow **8**, 26-36 (1987).

Extremet, G. P., Roux, B., Bontoux, P., and Elie, F., "Two-dimensional Model for Thermal and Solutal Convection and Multizone Physical Vapor Transport," J. Cryst. Growth **82**, 761-775 (1987).

Garcia-Ybarra, P. L., Castillo, J. L., and Velarde, M. G., "A Non-linear Evolution Equation for Benard-Marangoni Convection with Deformable Boundary," Phys. Lett. A **122**, 101-110 (1987).

Heiss, T., Schneider, S., and Straub, J., "G-Jitter Effects on Natural Convection in a Cylinder - A Three Dimensional Numerical Calculation," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 517-524.

Henry, D. and Roux, B., "Numerical Study of the Perturbation of Soret Experiments by Three-Dimensional Buoyancy-Driven Flows," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 487-491.

Henry, D. and Roux, B., "3D Numerical Study of Convection in a Cylindrical Thermal Diffusion Cell. Its Influence on the Separation of Constituents," Phys. of Fluids **29**, 3562-2572 (1986).

Henry, D. and Roux, B., "3-dimensional Study of Convection in a Cylindrical Thermal Diffusion Cell. Its Influence of the Inclination of the Cell," Phys. of Fluids **30**, 1656-1666 (1987).

Klein, H. and Wanders, K., "Holographic Interferometry Near Gas/Liquid Critical Points: Results of Spacelab D1," Acta Astron. **15** (1987).

Klein, H. and Feuerbacher, B., "Gravity Influence on Thermal Relaxion Near the Critical Point," Phys. Lett A **123**, 183 (1987).

Lamprecht, R., Schwabe, D., and Scharmann, A., "Thermocapillary and Buoyant Convection in an Open Cavity under Normal and Reduced Gravity," J. Fluid Mech., 1987.

Langbein, D., "Mischen und Entmischen Transparenter Flussigkeiten," Z. Flug. Welt. **11**, 29-36 (1987).

Langbein, D., "Fluid Physics," in *Proceedings of the Norderney Symposium on Scientific Results of the German Spacelab Mission D1* (P.R. Sahn, R. Jansen, and M. Keller, eds.), 1987, pp. 93-104.

Langbein, D. and Roth, U., "Interactions of Bubbles, Particles and Unidirectional Solidification under Microgravity," in *Proceedings of the Norderney Symposium on Scientific Results of the German Spacelab Mission D1* (P.R. Sahn, R. Jansen, and M. Keller, eds.), 1987, pp. 309-314.

Legros, J. C., "Problems Related to Non-Linear Variations of Surface Tension," Acta Astron. 13, 617-703 (1986).

Legros, J. C. and Limbourg, M. C., "Liquid/Gas Interfaces under Microgravity Conditions," ESTEC EWP 1457, 28-41 (1986).

Limbourg-Fontaine, M. C., Petre, G., Legros, J. C., and Van Ransbeeck, E., "Thermocapillary Movements Around a Surface Tension Minimum under Microgravity Conditions. Part I. Technical Description of the Stem Experiments. D1 Mission of Spacelab," Acta Astron. 13, 197-208 (1986).

Limbourg-Fontaine, M. C., Legros, J. C., and Petre, G., "The Influence of a Surface Tension Minimum on the Convective Motion of a Fluid in Microgravity," Adv. Space Res. 6, 35-39 (1986).

Limbourg-Fontaine, M. C., Legros, J. C., and Petre, G., "Marangoni Convection Induced in a Fluid Presenting a Surface Tension Minimum as a Function of the Temperature," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 245-249.

Martinez, I., "Stability of Long Liquid Columns in Spacelab D-1," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 235-240.

Martinez, I., "Stability of Liquid Bridges: Results of SL-D1 Experiments," Acta Astron., in press.

Martinez, I. and Perales, J., "Liquid Bridge Stability Data," J. Cryst. Growth 78, 369-378 (1986).

Martinez, I. and Eyer, A., "Liquid Bridge Analysis of Silicon Crystal Growth Experiments under Microgravity," J. Cryst. Growth 75, 535-544 (1986).

Martinez, I., Haynes, M., and Langbein, D., "Fluid Statics and Capillarity," in *Fluid Science and Materials Science in Space*, Chapter II (H.U. Walter, ed.), Springer-Verlag, 1987, pp. 53-81.

Martinez, I. and Perales, J. M., "Bidimensional Liquid Bridges in a Gravity Field," Acta Astron., in press.

Meseguer, J., Sanz, A., and Lopez, J., "Liquid Bridge Breakages Aboard Spacelab D1," J. Cryst. Growth 78, 325-334 (1986).

Meseguer, J. and Sanz, A., "One-dimensional Linear Analysis of the Liquid Injection or Removal in a Liquid Bridge," Acta Astron., in press.

Monti, R., "The Onset of the Oscillatory Regimes in Marangoni Flows," Acta Astron. (in press).

Nahle, R., Neuhaus, D., Siekmann, J., Wozniak, G., and Srulijes, J., "Separation of Fluid Phases and Bubble Dynamics in a Temperature Gradient - A Spacelab D1 Experiment," Z. Flugwiss. Welt. (in press).

Napolitano, L. G., "Recent Developments of Marangoni Flows Theory and Experimental Results," Adv. Space Res. 6, 19 (1986).

Napolitano, L., Golla, C., and Viviani, A., "Effects of Variable Transport Properties on Thermal Marangoni Flows," Acta Astron. 13, 661-667 (1986).

Napolitano, L., Monti, R., and Russo, G., "Marangoni Convection in One and Two Liquids Floating Zones," Naturwissen. 73, 352-355 (1986).

Napolitano, L. G. and Monti, R., "Surface Driven Flows: Theoretical and Experimental Results," in *Proceedings of 6th European Symposium on Materials Science under Microgravity*, 1987, ESA SP-256, pp. 551-555.

Napolitano, L., Monti, R., Russo, G., and Golia, C., "Comparison Between D-1 Spaceborne Experiment and Numerical/Ground Experimental Work on Marangoni Flows," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 191-199.

Nitsche, K. and Straub, J., "The Critical "hump" of  $c_v$  under Microgravity-Results from the D1-Spacelab Experiment 'Warmekapazität,'" in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 109-116.

Nitsche, K. and Straub, S., "The Isochoric Specific Heat of Sulphur Hexafluoride SF<sub>6</sub> at the Critical Point under Microgravity Conditions," in *Proceedings of Norderney Symposium on Scientific Results of German Spacelab Mission D1* (P.R. Sahn, R. Jansen, and M. Keller, eds.), 1987, pp. 188-197.

Ouazzani, J., Bontoux, P., Elie, F., Peyret, R., and Roux, B., "Numerical Solution for Binary Mixture Flows. Applications to Crystal Growth Processing," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 291-301.

Perales, J. M., "Non-axisymmetric Effects on Long Liquid Bridges," Acta Astron., in press.

Perrot, F., Gastaud, F., Guenoun, P., and Beysens, D., "Spinodal Decomposition Patterns in a Isodensity Critical Binary Fluid: Direct Visualization and Light Scattering Analyses," Phys. Rev. A, in press.

Petre, G. and Wozniak, G., "Measurement of the Variation of Interfacial Tension with Temperature Between Immiscible Liquids of Equal Density," Acta Astron. 13, 669-672 (1986).

Randriamampianina, A., Bontoux, P., Roux, B., and Argoul, P., "Multistep Methods for Spectral Tau Chebyshev Approximation. Application to Rotating and Buoyancy Driven Internal Flows," in *Notes in Numerical Fluid Mechanics*, Volume 13 (D. Rues and W. Kordulla, eds.), Vieweg-Verlag, 1986, pp. 302-309.

Rossitto, F., Passerone, A., Sangiogi, R., and Minisini, R., "Liquid Bridges Formed by Immiscible Metals: A Soundiong Rocket Experiment," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 215-219.

- Roux, B., Bontoux, P., and Henry, D., "Numerical and Theoretical Study of Different Flow Regimes Occurring in Horizontal Fluid Layers Differentially Heated," in *Lecture Notes in Physics*, Springer-Verlag, 1985, pp. 202-217.
- Sanz, A., Meseguer, J., and Mayo, L., "The Influence of Gravity on the Solidification of a Drop," *J. Cryst. Growth* **82**, 81-8 (1987).
- Sarma, G.S.R., "Interaction of the Surface Tension Buoyancy Mechanisms in a Horizontal Liquid Layer," *J. Thermophys. Heat Transf.* **1**, 129-135 (1987).
- Sarma, G.S.R., "Interfacial Effects on the Onset of Convection in Horizontal Liquid Layers," in *Physicochemical Hydrodynamics: Interfacial Phenomena* (M.G. Velarde, ed.), Plenum Publishing, 1987.
- Siekmann, J. and Szymczyk, J., "On the Thermocapillary Motion of a Bubble in a Low Gravitational Environment," in *Proceedings of the 15th International Symposium on Space Technology and Science*, Tokyo, 1986, pp. 2137-2148.
- Siekmann, J. and Schilling, U., "Computational Study of the Free Oscillations of a Liquid Drop by Means of the Boundary Element Method," in *Proceedings of the International Conference on Fluid Mechanics*, Peking University Press, 1987, pp. 1241-1246.
- Siekmann, J. and Wozniak, G., "Thermocapillary Bubble Migration in Microgravity at Higher Marangoni and Reynolds Numbers," in *Collection of Papers of the 29th Israel Annual Conference on Aviation and Astronautics*, Ayalon Offset Ltd., 1987, pp. 37-40.
- Szymczyk, J. A., Wozniak, G., and Siekmann, J., "On Marangoni Bubble Motion at Higher Reynolds and Marangoni Numbers under Microgravity," *Appl. Micro. Techn.*, 1988 (in press).
- Turner, D. J., "Electrolyte Solutions near the Critical Point of Water," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 125-129.
- Turner, D. J., "Salt Solution in Supercritical Water: Some Preliminary Studies on the Influence of Gravity," *J. Chem. Soc. Farad. Trans. I*, in press.
- Velarde, M. G., Garcia-Ybarra, P. L., and Castillo, J. L., "Interfacial Oscillations in Benard-Marangoni Layers," *Physiochem. Hydrodyn.* **9**, 387-392 (1987).
- Velarde, M. G. and Garcia-Ybarra, P. L., "Oscillatory and Other Benard-Marangoni Instabilities in Luid Layers under Microgravity Conditions," in *Proceedings of 6th European Symposium on Materials Sciences under Microgravity*, ESA SP-256, 1987, pp. 45-48.
- Villers, D. and Platten, J. K., "Couplage entre les Convections Capillaire et Gravitationnelle dans les Melanges," in *Proceedings of 6th European Symposium on Materials Sciences under Microgravity*, ESA SP-256, 1987, pp. 147-150.
- Vreeburg, J.P.B., "Observations on Behaviour of Liquid in Weightlessness," in *Proceedings of Symposium on Fluid Dynamics and Space*, ESA SP-265, pp. 126-136.

Vreeburg, J.P.B. and Vogels, M.E.S., "Liquid Motions in Partially Filled Containers: Preliminary Results of the D-1 Mission," Adv. Space Res. 6, 88 (1986).

Wadih, M. and Roux, B., "Natural Convection for Supercritical Conditions in Oscillatory Microgravity Environment (g-jitter)," Adv. Space Res. 6(5), 45-50 (1986).

Zell, M. and Straub, J., "Microgravity Pool Boiling - TEXUS and Parabolic Experiments," in *Proceeding of 6th European Symposium on Material Science under Microgravity Conditions*, ESA SP-256, 1987, pp. 155-160.

## Biotechnology

Bucker, H., Facius, R., Horneck, G., Reitz, G., Graul, E. H., Berger, H., Hoffken, H., Ruther, W., Heinrich, W., Beaujean, R., and Enge, W., "Embryogenesis and Organogenesis of *Carausius Morosus* under Spaceflight Conditions," Adv. Space Res. 6, 115-124 (1986).

## Glasses and Ceramics

Braetsch, V. and Frischat, G. H., "Influence of Microgravity on the Homogeneity of Glasses," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 259-262.

Braetsch, V. and Frischat, G. H., "Homogeneity of Glasses as Prepared under Microgravity and 1G Melting Conditions," in *Proceedings of Norderney Symposium on Scientific Results of the German Spacelab Mission D1*, 1987, pp. 166-171.

Gillessen, F., Herlach, D. M., and Feuerbacher, B., "Transformation Kinetics and Bulk Glass Formation of Pd-Ni-P," Z. Phys. Chem., in press.

Herlach, D. M., and Gillessen, F., "Pd<sub>3</sub>Si Nucleation in Undercooled Pd-Cu-Si Melts," J. Phys. E, in press.

Jeschke, V. and Frischat, G. H., "Gas Bubbles in Glass Melts under Microgravity, Part II: Helium Diffusion," Phys. Chem. Glasses 28, 1987).

Kiminami, C. S. and Sahn, P. R., "Kinetics of Crystal Nucleation and Growth in Pd<sub>77.5</sub>Si<sub>16.5</sub>Cu<sub>6</sub> Glass," Acta Met., 1986 (in press).

Zarzycki, J., Frischat, G. H., and Herlach, D. M., "Glasses," in *Fluid Science and Materials Science in Space*, Chapter 17 (H.U. Walter, ed.), Springer-Verlag, 1987, pp. 599-636.

## Experimental Technology

Hamacher, H. and Merbold, U., "The Microgravity Environment of the Material Science Double Rack during Spacelab-1," J. Spacecraft & Rockets, 1987 (accepted).

Hamacher, H., Merbold, U., and Jilg, R., "Analysis of Microgravity Measurements Performed during D1," in *Proceedings of the Norderney Symposium on Scientific Results of the German Spacelab Mission D1* (P.R. Sahm, R. Jansen, and M. Keller, eds.), 1987, pp.48-56.

Piller, J., Knauf, R., Preu, P., Lohofer, G., and Herlach, D. M., "Electromagnetic Positioning and Inductive Heating under Micro-g," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, 1987, ESA SP-256, pp. 437-444.

Reitz, G., Bucker, H., Beaujean, R., Enge, W., Facius, R., Heinrich, W., Ohrndorf, T., and Schopper, E., "Dosimetric Mapping Inside BIORACK," Adv. Space Res. 6, 107-113 (1986).

Steinborn, W., "Experimental Hardware-Furnaces," in *Materials Sciences in Space* (B. Feuerbacher, H. Hamacher, and R.J. Naumann, eds.), Spring Verlag, 1986, pp. 227-265.

Steinborn, W., Friedrich, U., Hey, G., Walther, S. Engelin, I., Mang, V., and Junk, P., "BIOTEX, an Element for the Next Generation of Microgravity Missions," in *Proceedings of the Norderney Symposium on Scientific Results of the German Spacelab Mission D1* (P.R. Sahm, R. Jansen, and M.H. Keller, eds.), 1987, pp. 465-472.

Wanders, K., Klein, H., Bewersdorff, A., and Neuhaus, D., "Holographic Experiments: Results of Spacelab D1," in *Proceedings of 6th European Symposium on Material Sciences under Microgravity Conditions*, ESA SP-256, 1987, pp. 105-107.

## General Studies

Bauer, H. F., Dynamic Behavior of Astronauts and Satellites Outside an Orbiting Space Station under the Influence of Thrust," Z. Flug. Wiss. Welt. 11, 12-18 (1987).

Monti, R., Langbein, D., and Favier, J. J., "Influence of Residual Accelerations on Fluid Physics and Materials Sciences Experiments," in *Fluid Science and Materials Science in Space*, Chapter 18 (H.U. Walter, ed.), Springer-Verlag, 1987, pp. 637-680.

Napolitano, L. G., "Prospects and Problems in Microgravity Fluid Science," Space Technol. 7, 149 (1987).

Richter, J. and Behret, H., "Physical Chemistry - Overview and Selected Experiments," in *Fluid Science and Materials Science in Space*, Chapter IV (H.U. Walter, ed.), Springer-Verlag, 1987, pp. 141-190.

Seibert, G., "Microgravity Research, Present Status and Future Prospects," Zeit. f. Flug. Welt. 10, 304-311 (1986).

Steinborn, W., "The German Programme on Materials Sciences in Space," Earth-Orient. Appl. Space Techn. 6, 113-116 (1986).

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