NASA TECHNICAL MEMORANDUM

NASA TM-82425

MATERIALS PROCESSING IN SPACE: A SURVEY OF REFEREED OPEN LITERATURE PUBLICATIONS

Compiled by F. Pentecost
Space Sciences Laboratory

July 1981

NASA

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama
This document is a bibliography by year of the research published in the open literature by the workers in the Materials Processing in Space program. This work was sponsored by NASA, either directly or indirectly, and generally pertains to the influence (or lack of influence) of gravity on processes involved in crystal growth, solidification, fluid transport, containerless phenomena, and various separation techniques of interest to the biomedical community. Also included are studies of the possibilities of using the high vacuum in the wake of orbiting vehicles for performing processes involving large heat inputs and evolution of gases.
FOREWORD

This document is a bibliography by year of the research published in the open literature by the workers in the Materials Processing in Space program. (Also included are a listing of submitted papers for which acceptance is pending and an appendix which provides a complete listing of the bibliography arranged alphabetically.) This work was sponsored by NASA, either directly or indirectly, and generally pertains to the influence (or lack of influence) of gravity on processes involved in crystal growth, solidification, fluid transport, containerless phenomena, and various separation techniques of interest to the biomedical community. Also included are studies of the possibilities of using the high vacuum in the wake of orbiting vehicles for performing processes involving large heat loads and evolution of gases.

The research reported in this document has a widely varying scope. For the most part, it represents ground-based studies aimed at exploring the role of gravity in a process, how to control its effects, and the determination of the limitations of ground-based techniques. It is anticipated that flight experiments will evolve naturally from this type of research. In cases where a clear rationale for space experiments has been perceived and the experiment is under development, much ancillary work is required to assure the success of the experiment. Often this work is of sufficient interest to merit publication in the open literature. Finally, work actually done in low gravity, either in early spaceflight experiments, current rocket flights, or in drop towers, drop tubes, and aircraft flying ballistic trajectories, is reported.

It is particularly noteworthy that the number of open literature publications produced by the program has increased dramatically in recent years. This reflects the emphasis on science recommended by the National Academy of Science (STAMPS Report*) and the philosophy of the present program administration.

Robert J. Naumann
Program Scientist

# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLICATIONS</td>
<td>1</td>
</tr>
<tr>
<td>1970</td>
<td>2</td>
</tr>
<tr>
<td>1971</td>
<td>3</td>
</tr>
<tr>
<td>1972</td>
<td>4</td>
</tr>
<tr>
<td>1973</td>
<td>5</td>
</tr>
<tr>
<td>1974</td>
<td>6</td>
</tr>
<tr>
<td>1975</td>
<td>7</td>
</tr>
<tr>
<td>1976</td>
<td>9</td>
</tr>
<tr>
<td>1977</td>
<td>10</td>
</tr>
<tr>
<td>1978</td>
<td>12</td>
</tr>
<tr>
<td>1979</td>
<td>15</td>
</tr>
<tr>
<td>1980</td>
<td>18</td>
</tr>
<tr>
<td>1981</td>
<td>21</td>
</tr>
<tr>
<td>SUBMITTED ARTICLES</td>
<td>25</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>29</td>
</tr>
</tbody>
</table>
1970

1972


1976


1977


1979


Anderson, P. M. and Lord, A. E., "Correlation Between Viscous Flow and DSC Measurements at the Glass Transition in the Metallic Glass Alloy Fe_{40}Ni_{40}P_{14}B_{6}," Mat. Sci. Engr. 43, 267-270 (1980).


SUBMITTED ARTICLES
The following articles have been submitted to journals. Acceptance is pending.


Chang, C. J. and Brown, R. A., "Radial Segregation Induced by Natural Convection and Melt/Solid Interface Curvature in Melt Crystal Growth," submitted to *Journal of Crystal Growth*.


Snyder, R. S. and McGuire, J. K., "Characterization of Continuous Flow Electrophoresis for Improving Resolution and Throughput," submitted to Electrophoresis.


Vydyanath, H. R., "Lattice Defects in Hg_1-xCd_xTe," Alloys II - Defect Structure of Indium Doped Hg_{0.8}Cd_{0.2}Te," submitted to Journal of Electrochemical Society.

Vydyanath, H. R. and Nelson, D. A., "Lattice Defects in Hg_{1-x}Cd_xTe Alloys, I - Defect Structure of Undoped and Copper Doped Hg_{0.8}Cd_{0.2}Te," submitted to Journal of Electrochemical Society.

Vydyanath, H. R., Donovan, J. C., and Nelson, D. A., "Lattice Defects in Hg_{1-x}Cd_xTe Alloys, III - Defect Structure of Undoped Hg_{0.6}Cd_{0.4}Te," submitted to Journal of Electrochemical Society.


Wiedemeier, H. and Chandra, D., "Chemical Vapor Transport and Crystal Growth of Hg_{0.8}Cd_{0.2}Te Systems: Effects Inclination of the Density Gradient with Respect to the Gravity Vector," submitted to Journal of Electrochemical Society.

APPENDIX

LIST OF PUBLICATIONS ARRANGED ALPHABETICALLY


Anderson, P. M. and Lord, A. E., "Correlation Between Viscous Flow and DSC Measurements at the Glass Transition in the Metallic Glass Alloy Fe_{40}Ni_{x}Z_{40}P_{14}B_{6}," Mat. Sci. Engr. 43, 267-270 (1980).


The following articles have been submitted to journals. Acceptance is pending.


Snyder, R. S. and McGuire, J. K., "Characterization of Continuous Flow Electrophoresis for Improving Resolution and Throughput," submitted to Electrophoresis.


Vydyanath, H. R., "Lattice Defects in Hg$_{1-x}$Cd$_x$Te," Alloys II - Defect Structure of Indium Doped Hg$_{0.8}$Cd$_{0.2}$Te," submitted to Journal of Electrochemical Society.

Vydyanath, H. R. and Nelson, D. A., "Lattice Defects in Hg$_{1-x}$Cd$_x$Te Alloys, I - Defect Structure of Undoped and Copper Doped Hg$_{0.8}$Cd$_{0.2}$Te," submitted to Journal of Electrochemical Society.

Vydyanath, H. R., Donovan, J. C., and Nelson, D. A., "Lattice Defects in Hg$_{1-x}$Cd$_x$Te Alloys, III - Defect Structure of Undoped Hg$_{0.6}$Cd$_{0.4}$Te," submitted to Journal of Electrochemical Society.


Wiedemeier, H. and Chandra, D., "Chemical Vapor Transport and Crystal Growth of Hg$_{0.8}$Cd$_{0.2}$Te Systems: Effects Inclination of the Density Gradient with Respect to the Gravity Vector," submitted to Journal of Electrochemical Society.

MATERIALS PROCESSING IN SPACE: A SURVEY OF REFEREED OPEN LITERATURE PUBLICATIONS

Compiled by E. Pentecost

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

ROBERT J. NAUMANN
Chief, Space Processing Division

CHARLES A. LUNDQUIST
Director, Space Sciences Laboratory