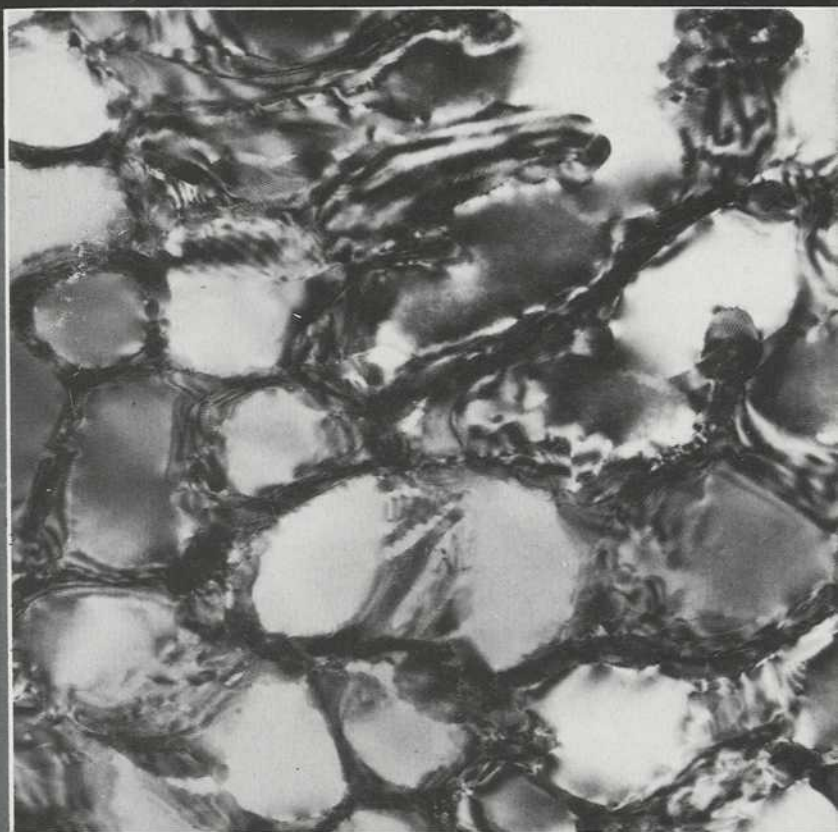


Rapidly Solidified Powder Aluminum Alloys



Fine/Starke, editors

ASTM STP 890

RAPIDLY SOLIDIFIED POWDER ALUMINUM ALLOYS

A symposium
sponsored by ASTM
Committee B-9 on
Metal Powders and
Metal Powder Products
Philadelphia, PA, 4-5 April 1984

ASTM SPECIAL TECHNICAL PUBLICATION 890
Morris E. Fine, Northwestern University, and
Edgar A. Starke, Jr., University of Virginia
editors

ASTM Publication Code Number (PCN)
04-890000-04



1916 Race Street, Philadelphia, PA 19103

Library of Congress Cataloging-in-Publication Data

Rapidly solidified powder aluminum alloys.

(ASTM special technical publication; 890)

"ASTM publication code number (PCN) 04-890000-04."

Includes bibliographies and indexes.

1. Powder metallurgy—Congresses. 2. Aluminum alloys—Congresses.
3. Aluminum alloys—Rapid solidification processing—Congresses.

I. Fine, Morris E. II. Starke, E. A., Jr. III. ASTM Committee B-9
on Metal Powders and Metal Powder Products. IV. Series.

TN697.A47R36 1986 669'.722 86-7887

ISBN 0-8031-0442-1

Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1986

Library of Congress Catalog Card Number: 86-7887

NOTE

The Society is not responsible, as a body,
for the statements and opinions
advanced in this publication.

Foreword

The symposium on Rapidly Solidified Powder Aluminum Alloys was held in Philadelphia, Pennsylvania, on 4-5 April 1984. The event was sponsored by ASTM Committee B-9 on Metal Powders and Metal Powder Products. Presiding as chairmen of the symposium were Morris E. Fine, Northwestern University, and Edgar A. Starke, Jr., University of Virginia, both of whom also served as editors of this publication.

ASTM Editorial Staff

**Helen P. Mahy
Janet R. Schroeder
Kathleen A. Greene
William T. Benzing**

A Note of Appreciation to Reviewers

The quality of the papers that appear in this publication reflects not only the obvious efforts of the authors but also the unheralded, though essential, work of the reviewers. On behalf of ASTM we acknowledge with appreciation their dedication to high professional standards and their sacrifice of time and effort.

ASTM Committee on Publications

Contents

Overview	1
INTRODUCTORY PAPERS	
The Need for Rapidly Solidified Powder Metallurgy Aluminum Alloys for Aerospace Applications—WILLIAM E. QUIST AND RICHARD E. LEWIS	7
Discussion	37
Use of Rapidly Solidified Aluminum Alloys in Land Vehicles—JEFFREY WALDMAN	39
Microstructural Scaling Laws for Dendritically Solidified Aluminum Alloys—MARTIN E. GLICKSMAN AND NARSINGH B. SINGH	44
Stereological Characterization of Porous Microstructures—ROBERT T. DeHOFF	62
POWDERS	
Characterization of Rapidly Solidified Materials—JANET M. SATER, T. H. SANDERS, JR., AND R. K. GARRETT, JR.	83
Rapid Solidification of Highly Undercooled Aluminum Powders—JOHN H. PEREPEZKO, STEPHEN E. LeBEAU, BOYD A. MUELLER, AND GREGORY J. HILDEMAN	118
Al₃Li Precipitate Modification in an Al-Li-Zr Alloy—FRANK W. GAYLE AND JOHN B. VANDER SANDE	137
Discussion	152
Hardening Mechanism in Rapidly Solidified Al-8Fe Alloy—SALIM DERMARKAR	154

A Comparative Evaluation of Aluminum Alloy Powders Used for Fabricating High-Strength Powder Metallurgy Extrusions— JAMES W. BOHLEN, RAMESH J. KAR, AND GOVIND R. CHANANI	166
Discussion	185
Rapid Solidification and Subsequent Analysis of Some Hypereutectic Aluminum-Based Alloys— JACOB W. ZINDEL, JAMES T. STANLEY, ROBERT D. FIELD, AND HAMISH L. FRASER	186
Physical Metallurgy and Mechanical Properties of Aluminum Alloys Containing Eight to Twelve Weight Percent Iron— DAVID J. SKINNER, KENJI OKAZAKI, AND COLIN M. ADAM	211
Ultralow-Density, High-Modulus, and High-Strength RSP Al-Li-Be Alloys— ALDO E. VIDOZ, DONALD D. CROOKS, RICHARD E. LEWIS, IAN G. PALMER, AND JEFFREY WADSWORTH	237
Microstructure of Supercooled Submicrometre Aluminum-Copper Alloy Powder— STEPHEN D. RIDDER AND DAN SHECHTMAN	252
Influence of Hydrogen on the Ductility of 7091 and 7090 PM Aluminum Alloys— JEAN MEUNIER	260

CONSOLIDATION AND PROCESSING

Powder Metallurgy Processing of Aluminum Alloy 7091— WALTER M. GRIFFITH, YOUNG-WON KIM, AND FRANCIS H. FROES	283
Dynamic Compaction of Rapidly Solidified Aluminum Alloy Powders— JAMES W. SEARS, DEAN J. MILLER, AND HAMISH L. FRASER	304
Effects of Alloy Chemistry on Superplastic Forming of Rapid- Solidification-Processed Aluminum-Lithium Alloys— RICHARD J. LEDERICH, PETER J. MESCHTER, AND SHANKAR M. L. SASTRY	319

Thermomechanical Treatment of 2124 PM Aluminum Alloys with Low and High Dispersoid Levels—BHASKAR SARKAR AND W. BARRY LISAGOR	333
--	-----

Effective Method for Degassing Evaluation of Aluminum PM Alloys—SUSAN D. KIRCHOFF, JAMES Y. ADKINS, WALTER M. GRIFFITH, AND IVAN A. MARTORELL	354
--	-----

CHARACTERIZATION AND PROPERTIES

Developments in Premium High-Strength Powder Metallurgy Alloys by Kaiser Aluminum—STEVEN W. PING	369
---	-----

Techniques for Assessing the Corrosion Properties of Aluminum Powder Metallurgy Alloys—JOSEPH R. PICKENS	381
---	-----

Development of Dispersion-Strengthened Aluminum Alloys— SHARON L. LANGENBECK, WALTER M. GRIFFITH, GREGORY J. HILDEMAN, AND JIM W. SIMON	410
--	-----

Microstructure/Mechanical Property Relationships for Various Thermal Treatments of Al-Cu-Mg-X PM Aluminum Alloys— LINDA B. BLACKBURN	423
---	-----

Characterization of Al-Fe-Ce Alloys—SHARON L. LANGENBECK, JAMES M. COX, AND ROD F. SIMENZ	450
--	-----

Engineering Property Comparisons of PM and IM Aluminum Alloy Forgings—RUSSELL J. H. WANHILL AND LAMBERT SCHRA	464
--	-----

Annealing Behavior and Tensile Properties of Elevated-Temperature PM Aluminum Alloys—YOUNG-WON KIM AND WALTER M. GRIFFITH	485
--	-----

Effect of Compositional Variations on the Microstructure and Properties of Rapidly Solidified Al-3Li Alloys— PETER J. MESCHTER, PETER S. PAO, RICHARD J. LEDERICH, AND JAMES E. O'NEAL	512
---	-----

An Evaluation of the Benefits of Utilizing Rapid Solidification for Development of 2XXX (Al-Cu-Mg) Alloys— HENRY G. PARIS AND DAVID J. CHELLMAN	527
--	-----

