

Contrails

ASD TECHNICAL REPORT 61-322

MATERIALS SYMPOSIUM

13-15 SEPTEMBER 1961

HOTEL WESTWARD HO

Phoenix, Arizona

JULY 1961

Directorate of Materials and Processes

U.S.A.F., AERONAUTICAL SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

McGregor & Werner, Inc., Dayton, O.
3000-September 1961 / 1-1

Contrails

FOREWORD

The increasingly rapid pace of modern technology throughout the world makes it imperative that our Air Force research programs be daringly imaginative and that our efforts include high risk items in order to accelerate progress. Weapon systems for the space ages of the future will be totally different from past and present types and will of necessity involve fantastically complex structures and components with greatly increased operational lifetimes and extremely high reliability. At the same time many more immediate problems must be solved. Such things as creep and fatigue in applications calling for long operational lifetimes, light weight structures for vertical takeoff or landing aircraft and high temperature tires must receive careful attention. These requirements cannot be met until materials scientists and engineers provide the essential ingredients for them. In order to meet the bare essentials of our programs, greatly accelerated progress in materials will be needed.

At the NATO Symposium on Materials Research which was held last June, it was pointed out that such efforts should follow two paths. First, somewhat empirical engineering will have to be continued with its attacks aimed at solving specialized and specific problems encountered in particular applications. Secondly, expanded use must be made of more fundamental studies involving chemistry and physics and other sciences and especially interdisciplinary research. All these efforts must be closely integrated to avoid delays.

The two previous meetings of this type were most helpful in providing the free exchange of ideas which can accelerate progress. It is expected that the papers presented here will be even more useful in conveying Air Force requirements to materials engineers and scientists throughout the defense community.



W.A. DAVIS
Major General, USAF
Commander

TABLE OF CONTENTS

	PAGE
SPACE ENVIRONMENT M.B. Gilbert, AFCRL	1
STRUCTURAL MATERIALS B. Chasman, ASD	8
A New Look at Superalloys Capt. L.F. Bubba, ASD	25
Structural Materials to 1800°F (Steel and Titanium) P.L. Hendricks, ASD	40
Graphite Capt. R.H. Wilson, ASD	57
Plastics, Adhesives, and Composite Materials F.W. Kuhn, G.P. Peterson, R.C. Tomashot, ASD	79
Protection of Refractory Metals Against Atmospheric Environments N.M. Geyer, ASD	101
Vapor Pressure Measurement P.W. Dimiduk, ASD	121
The Thermodynamics of Ablation Dr. E. Rutner, ASD	140
Meteoritics and Hypervelocity Studies A.K. Hopkins, ASD	152
Materials Information and Design Data D. Shinn, ASD	173
Elemental Micro Analysis H.M. Rosenberg, ASD	187
Chemical Analysis of Solid State Materials by Mass Spectrometry W.L. Baun, ASD	196
The Future of Analytical Chemistry Dr. L. Harrah, ASD	217
Molecular Weight Measurement Mary T. Ryan, ASD	221
Microwave Ferrites J.B. Brauer, N.O. Korolkoff, RADC	229

TABLE OF CONTENTS (Cont'd)

	PAGE
Hard Magnetic Materials Dr. K. Strnat, ASD	242
Soft Magnetic Metallic Materials J.C. Olson, ASD	252
ELECTRONIC MATERIAL REQUIREMENTS F.E. Wenger, AFSC	267
Dielectric Materials for Advanced Astronautic Weapons Systems W.G.D. Frederick, J.I. Wittebort, ASD	275
Some Aspects of New Polymers for Dielectrics Dr. G.F.L. Ehlers, ASD	289
Progress on the Research of Solid State Phenomena and Materials Capt. W. Metscher, ASD	296
Refractory Metals as Engineering Materials T.D. Cooper, ASD	307
Aerospace Working Fluids D.A. Kirk, Lt. J. Roth, H. Adams, ASD	339
Aerospace Lubricants H.W. Adams, ASD	356
Advanced Lubrication Techniques G.A. Beane, ASD	382
Elastomers Dr. W.E. Gibbs, W. R. Griffin, R. G. Spain, ASD	393
Thermal Emittance Measurements R. A. Winn, ASD	423
Environmental Considerations for Thermal Protective Coatings R.M. VanVliet, J.J. Mattice, ASD	436
Coatings for Temperature Control in Space Vehicles J.H. Weaver, Lt. C. Jacobs, ASD	456
Thermal Protection H. Marcus, ASD	470
Refractory Emissive Coatings L.N. Hjelm, Lt. USAF, ASD	482

TABLE OF CONTENTS (Cont'd)

	PAGE
The Effect of Radiation on Solid State Materials and Devices Dr. B. Manning, AFCRL	505
Radiation Chemistry R.E. Rondeau, 1/Lt. USAF, Dr. J. Radell, ASD	514
Radiation Effects on Materials in Space R.L. Hickmott, G.H. Griffith, O.L. Donlon, O.V.P. Sessoms, T.W. Bailey, ASD	532
Transparent Materials R. Wittman, ASD	541
Unique Metallic Materials and Techniques Lt. Col. E.M. Kennedy, Jr., 1/Lt. S.A. Worcester, Jr., ASD	563
Materials Problems in Dynamic Energy Conversion Systems G.E. Thompson, ASD	589
Types of Thermionic Power Converters and Current Materials Limitation Capt. E.F. Redden, ASD	602
Solar Cells in Space R.W. Runnels, ASD	609
Materials for Energy Conversion Systems B. Rubin, ASD	615
FLIGHT VEHICLE POWER D. Mortel, ASD	636
IMPROVING THE MUTUAL GUIDANCE AND SUPPORT BETWEEN THE FIELDS OF MATERIALS AND DESIGN W.R. Micks, Rand	651
Welding and Brazing Space Age Materials R. Bowman, ASD	661
Ceramics and Intermetallics I.D. Larva, ASD	679
Organic and Inorganic Fibrous Materials J.H. Ross, ASD	711
Applied Research Program for Nondestructive Methods Development R.R. Rowand, ASD	739

TABLE OF CONTENTS (Cont'd)

	PAGE
The Nondestructive Measurements of Surface Connected Discontinuities W.L. Shelton, ASD	757
Ablative Materials D.L. Schmidt, ASD	775
Extrusion of High Temperature Materials P.S. Duletsky, Capt. USAF, ASD	817
Theoretical Formability J. Bryars, ASD	833
The Mechanical Behavior of Materials R.T. Ault, I.K. Ebcioğlu, D.M. Forney, Jr., R.F. Klinger, J.A. Roberson, K.D. Shimmin, and W.J. Trapp, ASD	845
Beryllium Research and Development S.S. Christopher, Lt. USAF, ASD	883
Materials for Molecular Electronics Elizabeth H. Tarrants, ASD	901