

## Contents

### PREFACE -- 2nd Edition

- 1 INTRODUCTION 1  
The Origins and History of Adhesives. Advantages and Disadvantages of Adhesive Bonds. Temperature Designation for Adhesive Bonding. References.
- 2 ADHESION THEORY -- REVIEW AND CRITIQUE 10  
Introduction. Bonding Sequence. Surface Characterization. Theory, Contributory Factors. Mechanism for Bond Failure. Contributory Factors. Summation. References.
- 3 CLEANLINESS AND SURFACE TREATMENT OF METALS 35  
The Concept of Cleanliness. General Cleaning Methods: Solvent Wiping, Vapor Degreasing, Abrasive Cleaning, Vapor Honing, Ultrasonic Cleaning, Combinations of Cleaning Methods. Compromises in the Cleaning Process. Specific Cleaning Processes: Aluminum, Copper and Copper Alloys, Beryllium, Carbon-Steel Metals, Stainless Steel, Titanium Magnesium, Plated Surfaces, Primers. References.
- 4 PRIMERS USED AS ADDITIVES 66  
Effectiveness of Primer. Characteristics With and Without Primer. Aging Effect on Primer Premix. Mechanism of Bond Failure. References.

## CONTENTS

### 5 JOINT DESIGN TEST SPECIMENS — STRESS RELATIONS

73

Joint Efficiency. Bond Efficiency. Joint Design. Test Specimens. Test Methods and ASTM: Shear Tests, Compression Tests, Tensile Tests, Peel Tests, Cleavage Tests, Creep Tests, Fatigue Tests, Impact Tests, Tests for Lightweight-core Panels. References.

### 6 ADHESIVE MATERIALS — STRUCTURAL

95

Phenolic Copolymers — Chemistry. Neoprene Adhesives. Vinyl Phenolics. Nitrile Rubber Phenolics. Epoxy Phenolics. Epoxies: Applications, Epoxy Formulating Ingredients, Curing Agents, Flexibilizers, Fillers, Processing. Two-Phase Nitrile Rubber, Phenolic/Epoxy Adhesive. Nylon Epoxies. Nitrile-Rubber Epoxy Adhesives. Supersonic Adhesives. Material Cost. References.

### 7 MISCELLANEOUS ADHESIVE MATERIALS

134

Twin-Tube Epoxy Kits. Alkyl Cyanoacrylates. Polysulfides. Silicones. Rubber-Base Solvent Types. Anaerobic Polyester. Vinyl Plastisols. Second Generation Acrylics. Hot Melts. References.

### 8 ADHESIVE SEALANTS

146

Polysulfides. Polysulfide Applications and Specifications. Polyurethanes. Polyurethane Applications. Silicones: Chemistry, Properties. References.

### 9 DURABILITY OF STRUCTURAL ADHESIVE BONDS

165

Introduction. Exposure Sites. Adhesive Types. Room-Temperature Cure Epoxies. Room-Temperature Cure Polysulfides. Room-Temperature Silicones. Intermediate-Temperature Cure Epoxies. Nitrile Rubber Phenolics. Nitrile Rubber Epoxies. Nylon Epoxies. Epoxy Phenolics. References.

## CONTENTS

- 10 ACTIVATED GAS TREATMENT OF SURFACES 191**  
Introduction. Active and Inert Gases. Safety Precautions. Improvement in Wettability and Bondability. Surface Energy. RTV Silicones. Epoxies. Pressure Variable. Power Level. Air vs. Oxygen. References.
- 11 SURFACE PREPARATION AND BONDING OF NON-METALLIC MATERIALS 200**  
Introduction. Optical Glass. Glazed Ceramics and Glass. Porous Ceramics. Non-Silicone Rubbers. Silicone Rubbers. Thermoplastics. Acrylics. Cellulose. Polystyrene. ABS; SAN; SB. Polyvinyl Chlorides. Polycarbonates. Nylon. Polyolefins. Heat Bonding of Thermoplastics. PTFE and PCTFE. Thermosets. References.
- 12 WOOD AND PAPER 214**  
Introduction. Surface Treatment. Animal Glues. Vegetable Glues. Urea Formaldehyde. Resorcinol Formaldehyde. Epoxies. General Purpose Wood Glues. Adhesives for Paper. Vegetable Source: Dextrins, Gum Arabic, Gum Tragacanth. Hot Melts. References.
- 13 STRESS RELIEF, VIBRATION ISOLATION, AND VIBRATION DAMPING 218**  
Stress Relief. Vibration and Static Fatigue. Vibration-Damping Mounts. References.
- 14 INDUSTRIAL PROCESS OF ADHESIVES AND BONDED ASSEMBLIES 234**  
Fastening Methods. Simple Procedure. "Two-Part Plus" Adhesives. Ovens. Presses. Autoclaves. Temperature. Pressure Monitoring. Vacuum Venting. Bonding of Extra-Large Parts. Inspection of Bonded Parts: Destructive Inspection, Nondestructive Testing, Load Testing, Portashear Testing, Sonic Tests, Ultrasonic Testing, Thermal Transmission Methods. References.

## CONTENTS

### 15 INDUSTRIAL APPLICATIONS

253

Aircraft Industry. Automobile Industry. Boats and Trains. General Metal Bonding. Bonding of Abrasives and Cutting Tools. Impregnation of Porous Castings. Electrical/Electronic Industry: Bonded versus Unbonded Interfaces, Printed Circuits, Flexible Printed Circuits, Pressure Sensitive Components, Coils, Miscellaneous, Heat Sink Applications, Outgassing. References.

### 16 CONDUCTIVE ADHESIVES

279

Interfacial Resistance and Mixing Time. Copper-filled Epoxies. Applications. Test Method. Alternate Conductive Systems. Continuous Metal Conductivity. Wire Embedments in Conductive Epoxies: Materials, Experimental Data, Conclusion. References.

### 17 AGING CHARACTERISTICS OF ELECTRICALLY CONDUCTIVE ADHESIVES

298

Introduction. Filler Materials: Silver, Silver-Palladium, Gold. Aging Conditions. Types of Failure. References.

### APPENDIX A

312

ANSI/ASTM D 907-77. Standard Definitions of Terms Relating to Adhesives.

### APPENDIX B

325

ASTM Adhesive Standards. Specifications. Test Methods. Recommended Practices.

### APPENDIX C

329

Department of Defense Index of Specifications and Standards.

### SUBJECT INDEX

339