

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

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.

73

6 ADHESIVE MATERIALS — STRUCTURAL

95

Phenolic Copolymers — Chemistry. Neoprene Adhesives. Vinyl Phenolics. Nitrile Rubber Phenolics. Epoxy Phenolics. Epoxy Applications, Epoxy Formulating Ingredients, Curing Agents, Flexibilizers, Fillers, Processing. Two-Phase Nitrile Rubber, Phenolic/Epoxy Adhesive. Nylon Epoxy. 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 Epoxy. Room-Temperature Cure Polysulfides. Room-Temperature Silicones. Intermediate-Temperature Cure Epoxy. Nitrile Rubber Phenolics. Nitrile Rubber Epoxy. Nylon Epoxy. 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. Cellulosics. 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