

Boeing Simulates Thermal Expansion in Composites with Expanded Metal Foil for Lightning Protection of Aircraft Structures

Modern aircraft such as the Boeing 787 Dreamliner are comprised of more than fifty percent carbon fiber composite requiring the addition of expanded metal foil for lightning strike protection. Researchers at Boeing are using simulation to verify that protective coatings on the metal foil will not fail due to thermal stress arising from a typical flight cycle.

BY JENNIFER A. SEGUI

The Boeing 787 Dreamliner is innovative in that it is comprised of more than fifty percent carbon fiber reinforced plastic (CFRP) due to the material's light weight and exceptional strength. Figure 1 shows the extensive use of composite materials throughout the aircraft. Although CFRP composites

inherently have many advantages, they cannot mitigate the potentially damaging electromagnetic effects from a lightning strike. To solve this problem, electrically conductive expanded metal foil (EMF) can be added to the composite structure layout to rapidly dissipate excessive current

and heat for lightning protection of CFRP in aircraft.

Engineers at Boeing Research and Technology (BR&T) are using multiphysics simulation and physical measurements to investigate the effect of the EMF design parameters on thermal stress and displacement



FIGURE 1. Advanced composites used throughout the Boeing 787 account for more than fifty percent of the aircraft body¹.

Boeing Composites Design Manual

Donald V Rosato, Dominick V Rosato



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Reinforced Plastics Handbook Donald V Rosato, Dominick V Rosato, 2004-12-15 In this 3rd Edition of the Reinforced Plastics Handbook the authors have continued the approach of the late John Murphy author of the first and second editions The book provides a compendium of information on every aspect of materials processes designs and construction Fiber reinforced plastics are a class of materials in which the basic properties of plastics are given mechanical reinforcement by the addition of fibrous materials The wide choice of plastics resin matrices and the correspondingly wide choice of reinforcing materials mean that the permutations are virtually unlimited But the optimum properties of resin and reinforcement cannot be obtained unless there is an effective bond between the two and this is the continuing objective of reinforced plastics production design and processing New 3rd edition of this comprehensive practical manual This is a bible for all those involved in the reinforced plastics industry whether manufacturers specifiers designers or end users Has been completely revised and updated to reflect all the latest developments in the industry **Composite Materials** James Martin Whitney, 1986 **Scientific and Technical Aerospace Reports**, 1995 Handbook of Aluminum Bonding Technology and Data J. D. Minford, 1993-06-16 A reference that offers comprehensive discussions on every important aspect of aluminum bonding for each level of manufacturing from mill finished to deoxidized conversion coated anodized and painted surfaces and provides an extensive up to date review of adhesion science covering all significant **Composite Materials** Samuel P. Garbo, 1990 Annotation Papers from the symposium held April 1988 in Sparks Nevada The focus is on significant advances in the area of damage tolerance and durability of composite structures Twenty seven contributions address delamination initiation and growth analysis damage mechanisms and test procedures and other general interest design and analysis topics Annotation copyrighted by Book News Inc Portland OR *Advances in Composite Materials* A. R. Bunsell, 2013-10-02 *Advances in Composite Materials* is a collection of papers that discusses fiber reinforced composite materials pertaining to their mechanical and failure properties One paper explains the design and fabrication of a GrFRP concept car by the Ford Motor Company which uses as much as possible graphite fiber in the body chassis and powertrain Another paper discusses the sorption behavior of glass fiber reinforced composites as well as the influence of diffusing media on the deformation and failure behaviors One paper examines the physical elastic viscoelastic and inelastic properties of multiphase short fiber composite materials using the fiber aspect ratio fiber volume fraction and properties of the constituent phases as several variables Another paper describes a procedure to measure the changes in stiffness properties of a unidirectional fibrous composite such as glass fiber reinforced polyester caused by fatigue damage One application of carbon fiber reinforced thermoplastics is in a sleeve bush molded from nylon 66 containing 30 percent fiber reinforcement with PTFE and silicone oil The material has low frictional high wear performance characteristics The Penny and Giles Potentiometers Ltd use this component on a joystick for gun directional control The collection can prove useful for design engineers materials engineers

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Table of Contents Boeing Composites Design Manual

1. Understanding the eBook Boeing Composites Design Manual
 - The Rise of Digital Reading Boeing Composites Design Manual
 - Advantages of eBooks Over Traditional Books
2. Identifying Boeing Composites Design Manual
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in a Boeing Composites Design Manual
 - User-Friendly Interface
4. Exploring eBook Recommendations from Boeing Composites Design Manual
 - Personalized Recommendations
 - Boeing Composites Design Manual User Reviews and Ratings
 - Boeing Composites Design Manual and Bestseller Lists

5. Accessing Boeing Composites Design Manual Free and Paid eBooks
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6. Navigating Boeing Composites Design Manual eBook Formats
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 - Interactive Elements Boeing Composites Design Manual
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 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Boeing Composites Design Manual
9. Balancing eBooks and Physical Books Boeing Composites Design Manual
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Boeing Composites Design Manual
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 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
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 - Setting Reading Goals Boeing Composites Design Manual
 - Carving Out Dedicated Reading Time
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 - Fact-Checking eBook Content of Boeing Composites Design Manual
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

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- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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