Course R-4
Repair of Bonded Aluminum Structures

Course Summary

This course is designed for repair designers, technicians, mechanics, leads, supervisors, or inspectors who want to further their education in repairs of bonded aluminum structures.

Introduction

This mostly hands-on course provides a solid foundation in the principles of adhesively bonded repairs for aluminum structures, including face sheet bonding and repairs to aluminum honeycomb sandwich structures. While these subjects are briefly covered in our (M-4/R-7) Adhesive Bonding of Composites & Metals course, the emphasis in this course is strictly on aluminum bonded structures, including aluminum-specific surface preparations and bonding methods used in industry. Proper surface preparation for structural adhesive bonding is a complex subject, with many different techniques and processes being developed over the years. Some methods have proven to be deficient after many years of service, while others have been proven to maintain long-term durability but have significant health and safety and hazardous waste disposal problems. Newer techniques are available which mitigate many of these issues, but introduce additional complexities and process control issues of their own. These processes are discussed extensively in class and the students will perform many of these operations themselves while building test panels and doing repairs to existing parts during the week long course. Different surface preparation techniques are compared in class utilizing wedge coupons made in accordance with ASTM D 3762 methods/practices; including some deliberately poor, but commonly used surface preparation methods. These panels will be cured and tested to destruction to see the different effects. Emphasis is placed on newer techniques for repairs which not only give better results, but are in more environmentally friendly and easier to perform.

Topics

Key Lecture Topics:

- Fundamentals of structural adhesives.
- Various methods for surface preparation of aluminum and other metals.
- Bond line integrity, thickness, and contamination considerations.
- Aluminum honeycomb core materials and cell types.
- Repair of damaged aluminum sandwich structures.
- Adhesive cure cycle requirements; avoiding changes to aluminum hardness/temper.
- Vacuum bagging techniques that enhance bonded repairs.
- Destructive and non-destructive testing of bonded structures.
- Health and safety issues related to materials used in surface preparation and repair.

Workshop Exercises:

- Surface preparation of aluminum; applied to a number of aluminum panels and test specimens using the Boeing-developed and approved Phosphoric Acid Anodization (PAA) and Sol-Gel processes.
- Fabricate and test wedge coupons in accordance with ASTM D 3762 standards; compare various surface preparation methods, subject specimens to different environmental conditions and analyze failure modes.
- Manufacture bonded panels with film adhesives, using vacuum bag and hot-bond curing techniques.
- Repairs to actual damaged aluminum honeycomb sandwich structures.

Course Benefits

Attendees will obtain fundamental knowledge of best industry practices for conducting aluminum bonded structural repairs of which can immediately be applied in the workplace.

Prerequisites

None

Teaching Method

Active classroom lecture and workshop exercises: 20% Theory and 80% Practical

CEU

3.4