JOINT ADVANCED MATERIALS & STRUCTURES CENTER OF EXCELLENCE

Adhesive Bond Process Qualification Protocol

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ABSTRACT

Development of advanced material and process technologies has significantly increased the use of adhesively bonded joints in aircraft primary and secondary structures due to favorable characteristics of these joints in comparison with riveted, spot-welded, and mechanically fastened structures. However, the quality assurance of bonded joints is a challenging task due to the lack of reliable methods for nondestructively determining the bond strength. Certification agencies and regulators often develop a mistrust on bonded structures because the strength and the life of the joint cannot be determine with confidence and historical bonded structural failures, primarily due to improper bond processes including unacceptable surface preparation practices. Therefore, developing adhesive bond process qualification protocol is a critical step towards ensuring structural integrity of bonded joints. Such protocols must include methods for determining integrity of materials prior to processing, surface preparation procedures, nondestructive inspection (NDI) of prebond surfaces, process control (traveler) coupons, post-bond nondestructive evaluation for manufacturing defects, quality control procedures, and training of personnel. Note that different qualification protocols must be developed for different adherend materials. For example, the surface preparation techniques for composites and metals are significantly different. Further, different aluminum alloys, steel, and titanium surface preparation techniques have significant differences. The primary goal of this research program is to develop a bond qualification protocol (BQP) for quality assurance of bonded joints. Secondary goal is to develop procedures for including adhesive test data generated following such protocols into shared databases such as Composite Material Handbook (CMH-17).