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Controlled reduced-strength epoxy-aluminium joints validated by ultrasonic and mechanical measurements

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Abstract

In this study a series of joint systems, consisting of aluminium substrates bonded using an epoxy adhesive, were produced. Several levels of adhesion were achieved by altering the substrate surface treatment and the curing cycle of the adhesive. The goal of this study was to produce reduced-strength epoxy-aluminium joints that could be used as reference samples for ultrasonic non-destructive testing (NDT) studies. There is clearly a continuing challenge to improve the quality of the adhesively-bonded joint inspection to ensure the durability of the bonds, to monitor repairs, and to evaluate the strength of the bonds. However, developing and qualifying innovative or advanced non-destructive testing requires an essential preliminary step: a method for repeatedly producing reduced-strength bonded test specimens must be developed. In this study, in addition to a rigorous protocol to produce bonded joints, complementary ultrasonic CSCAN were realised to validate the homogeneity of the joints and to ensure that samples met all requirements so as to be considered as reference samples. Mechanical tests were performed to evaluate the mechanical strength of each joint and Acoustic Emission (AE) was used during the tests in order to confirm the expected fracture mechanisms.

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