ANALAYIS OF ADHESIVE JOINTS IN WIND TURBINE BLADES

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ABSTRACT

The vast majority of wind turbine blades are manufactured with adhesively bonded composites. Adhesive joints provide flexibility in manufacturing and structural design and, if properly engineered, have positive benefits in terms of overall blade reliability and cost. Adhesive joints used for wind turbine blades are subjected to cyclic multiaxis loading histories. The influence of mode mixity on the cyclic growth rate of flaws located along adhesive interfaces was investigated using DCB specimens loaded with uneven bending moments (DCB-UBM geometry). This specimen geometry allows testing over a large range of mode mixities and is well suited for adhesive joints in fiber-reinforced composites and laminates where large-scale fiber bridging can occur. An important aspect of laboratory testing is to ensure that the results obtained from test coupons can be reliably used to predict the behaviour of much larger structures. This is of particular importance for wind turbine blades where the time and costs of full scale testing are large. To study scaling effects, additional cyclic crack growth experiments were performed using larger specimens (1.2 m long) subjected to 4-point flexure and compared to predictions of crack growth rates made with the DCB-UBM specimens. The test results are used to provide preliminary guidelines for establishment of inspection intervals for wind turbine blades and for judging the effect of manufacturing-related defects on the reliability of wind turbine blades.