

Detection of Kissing Bonds in Adhesive Bondings using Nonlinear Ultrasound

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Kissing bonds are adhesion defects in bonded joints that are due to low adhesion forces between the adhesive and the substrate. These defects can be caused, for example, by a contaminated surface or incorrect surface pretreatment. The detection of kissing bonds is only possible to a limited extent with the currently used and known non-destructive testing methods (ultrasound, x-ray, thermography, shearography), since kissing bonds have no volume and no new interface is created. With the method of nonlinear ultrasound a detection of kissing bonds could be achieved in first tests. The kissing bond leads to a reduction in the stiffness of the bonded joint, resulting in an earlier transition from the linear to the nonlinear range in the stress-strain diagram. The non-existent adhesion also leads to a clapping effect, which results in an increase of the nonlinear vibration components. In this work, the use of nonlinear ultrasound for the detection of adhesion defects was investigated in more detail. For this purpose, test specimens were produced with two different adhesive systems (epoxy resin adhesive system and silicone based adhesive system) and reproducibly introduced kissing bonds. Subsequent testing by means of a laser doppler vibrometer allows the kissing bonds to be de-tected by analyzing the higher harmonic vibrations.