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Evaluation of Epoxy Crosslinking Using Ultrasonic Lamb Waves

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ABSTRACT

The use of epoxy adhesives in structural bonding provides lightweight materials, however the assessment of the integrity and quality of the joint is of critical concern. Thus it is essential to know if the adhesive is well crosslinked. This work deals with the nondestructive acoustic characterization of epoxy networks, representative of the adhesive family, of different crosslinking density; i.e. conversion. Different curing cycles were applied and differential scanning calorimetry measurements allowed the determination of their glass transition temperature and epoxy conversion. The acoustic study was performed on epoxy plane plates, all in the glassy state and well beyond the gel point. The methods were based on the propagation of bulk longitudinal and shear waves, as well as on guided Lamb waves. Depending on the conversion of the epoxy, it was shown that the changes in thermo-mechanical properties, resulting from different degrees of cure, greatly influence the acoustic behavior of some Lamb modes if a selection of the sensitive modes has been performed upstream.

Keywords: Epoxy networks, Conversion, Ultrasounds, Lamb waves

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