Assuring quality in lightweight construction

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Aerospace, automotive and airplane construction count on lightweight construction. But to make sure that lightening the load does not come at the cost of safety, Fraunhofer researchers are working on new quality assurance systems for material testing. At the Composites Europe trade show in Stuttgart, Germany, they will demonstrate a new kind of non-destructive diagnostic procedure.

Boats, airplanes and spacecrafts are getting lighter and lighter: Lightweight structures help save fuel and lower CO_2 emissions. "To ensure that police and marine emergency services can rely on their lifeboats, even in high seas, the lightweight components undergo comprehensive quality assurance before being put to actual use," affirms Joachim Montnacher, Head of Department for Testing Systems at the Fraunhofer Institute for Manufacturing Engineering and Automation IPA in Stuttgart. Together with Dr. Tina Wilhelm, Group Manager for Measurement and Testing Technology, and colleague Wolfgang Schmidt, the experts are hard at work on quality assurance systems for lightweight construction. At the Composites Europe trade show, the researchers will present a combination of two testing systems: shearography and thermography.

"Shearography is a laser optical procedure that allows measurement of material deformations in the triple-digit nanometer range. Thermography allows one to measure temperature differences on the surface of materials with accuracy of just a few Millikelvins. If an air pocket is enclosed on the adhesive side of a component, then the thermographic camera will measure different heat values than those of the properly

seamed locations. With shearography, the material expands differently at the site where a defect occurs," is how Wilhelm describes the test principle. For both procedures, the material must be stimulated mechanically, thermally or electrically, using force, ultrasound or light. The experts measure twice: Once before and once after the stimulus. The measurement values clearly indicate where delaminations, i.e. defects in the bonded connection, have occurred with the materials during processing.

"Depending on the procedure, various physical effects are used for the testing. What's important is that you can reliably detect defects with the two technologies - and specifically both on the surface and in the interior of the component. Since it is necessary to apply a stimulus to the materials being tested in any case, the combination allows you to eliminate one processing step, while simultaneously improving quality control," Montnacher summarizes the functional process of measurement and the advantage of the combination. At the trade show, the IPA researchers will demonstrate the two testing technologies on a clutch disk.

In the laboratory, the researchers are not only currently working on the combination of both measurement principles. An essential focal point of the working group is to ascertain for which materials shearography is best suited in order to find hidden delaminations, and when it is better to utilize thermography. "There is still a considerable amount of research needed," says Wilhelm.

Source: Fraunhofer-Gesellschaft (news : web)