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Accession number:20123915473070
Title:Effect of defect size on the measurement of defect depth using thermal wave imaging
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Source title:Hongwai yu Jiguang Gongcheng/Infrared and Laser Engineering
Abbreviated source title:Hongwai yu Jiguang Gongcheng Infrared Laser Eng.
Volume:41
Issue:7
Issue date:July 2012
Publication year:2012
Pages:1910-1915
Language:Chinese
ISSN:10072276
Document type:Journal article (JA)
Publisher:Chinese Society of Astronautics, P.O. Box 225-32, Tianjin, 300192, China
Abstract:Defect depth measurement is one of the major quantitative applications of thermal wave imaging and the current methods are based on 1D heat conduction model. However, since the practical depth measurement is to retrieve defect depth which is of limited size. 3D heat diffusion influences the precision of defect depth measurement. One aluminum sample whose surface was treated with anode oxidation and one fiber reinforced plastics (FRP) sample were used, and thermal wave imaging was used as experimental scheme to obtain the temperature decay data series. The temperature-time curves of different positions in each wedge were extracted to approximately simulate that different depth defects with the same defect size were affected with different levels of 3D heat diffusion. The theoretical procedures of three different thickness measurement methods were analyzed based on 1D heat conduction model, and the linear relationship between the characteristic time of each method and the square of defect depth was constructed. The results indicate that defect size influences the slope and intercept of each linearity, and the slope is affected more seriously when the thermal diffusivity is smaller.
Number of references:10
Main heading:Three dimensional computer graphics
Controlled terms:Aluminum - Fiber reinforced plastics - Heat conduction - Thickness gages - Thickness measurement
Uncontrolled terms:Anode oxidation - Characteristic time - Data series - Defect depth - Defect size - Experimental scheme - Heat conduction models - Heat diffusions - Linear relationships - Temperature decay - Temperature-time curves - Thermal wave imaging
Classification code:423.1 Non Mechanical Properties of Building Materials: Test Equipment - 541.1 Aluminum - 641.2 Heat Transfer - 723.5 Computer Applications - 817.2 Polymer Applications - 943.2 Mechanical Variables Measurements
Database:Compendex