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Nondestructive Evaluation of Hidden Delamination in Glass Fiber Composite Using Terahertz Spectroscopy

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Abstract : As the use of the composites was increased, the detecting method of hidden damages which have an effect on performance of the composite was important. Terahertz (THz) spectroscopy was assessed as one of the new powerful nondestructive evaluation (NDE) techniques for fiber reinforced composite structures because it has many advantages which can overcome the limitations of conventional NDE techniques such as x-rays or ultrasound. The THz wave offers noninvasive, noncontact and nonionizing methods evaluating composite damages, also it gives a broad range of information about the material properties. In additions, it enables to detect the multiple-delaminations of various nonmetallic materials. In this study, the pulse type THz spectroscopy imaging system was devised and used for detecting and evaluating the hidden delamination in the glass fiber reinforced plastic (GFRP) composite laminates. The interaction between THz and the GFRP composite was analyzed respect to the type of delamination, including their thickness, size and numbers of overlaps among multiple-delaminations in through-thickness direction. Both of transmission and reflection configurations were used for evaluation of hidden delaminations and THz wave propagations through the delaminations were also discussed. From these results, various hidden delaminations inside of the GFRP composite were successfully detected using time-domain THz spectroscopy imaging system and also compared to the results of C-scan inspection. It is expected that THz NDE technique will be widely used to evaluate the reliability of composite structures.

Keywords : terahertz, delamination, glass fiber reinforced plastic composites, terahertz spectroscopy
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