

# **Second- and third-order ultrasonic nonlinearity parameters measured in transmission mode and reflection mode**

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Acoustic nonlinearity parameter provides information related to high-order nonlinear elastic modulus and correlates with various material degradation damages. A technology that uses the magnitude of harmonics is mainly used to measure acoustic nonlinearity parameters. However, most of applications was limited to the measurement of the second order nonlinearity parameter using transmission mode. This is because techniques for measuring third or higher order nonlinearity stably had not been sufficiently developed and it is theoretically impossible to measure second order harmonic components in reflection mode due to phase inversion. Meanwhile, recently developed measurement technologies enable stable measurement of not only secondary harmonic but also, third harmonic components. Therefore, in this study, third-order nonlinearity parameters that are not affected by phase inversion were measured in reflection mode. Seven different high temperature heat-treated Al6061-T6 alloy specimens were tested and the second- and third-order nonlinear parameters measured in both of transmission and reflection modes were compared. For the experimental results, the second- and third- order nonlinear parameters showed the same tendency in transmission mode, whereas only the third-order nonlinear parameter in reflection mode, showed the same tendency with the results from transmission mode. Since the reflection mode is preferred in field applications, these results are expected to contribute to improve the field applicability of nonlinear ultrasound technology in the future. - This work was supported by the National Research Foundation of Korea funded by the Korea government (MSIT), 2021M2E6A1084690