

Optimal Design for Piezoelectric Ultrasonic Transducer for High Attenuative Materials

Kim, K. B.¹, Ahn, B., Kim, Y.G. Park, S. K., and Ha, J. S.²

¹Korea Research Institute of Standards and Science, Daejeon, Korea, ²Korea Electric Power Research Institute, Daejeon, Korea

Some materials being used in power plant are degraded because of long time service and hence their mechanical properties are changed. Since the ultrasonic energy is highly attenuated in the degraded material, it is very difficult to detect the crack in that material. This study was carried out to develop the piezoelectric ultrasonic transducer for stainless steel (SUS 316) used in power plant. The ultrasonic velocities and acoustic impedance of the degraded SUS 316 specimen were measured. In order to generate the highly efficient ultrasound in that materials, some lead zirconate titanates (PZT) with high piezoelectric constant (d_{31}) were selected. The simulation to find the optimal design conditions for main components of ultrasonic transducer such as piezoelectric materials, front matching layer, backing materials was performed using KLM model. Based on the simulation results, 1, 2.25 and 5 MHz of ultrasonic transducers for high attenuative materials were developed and their performances were compared to the commercial ultrasonic transducer.