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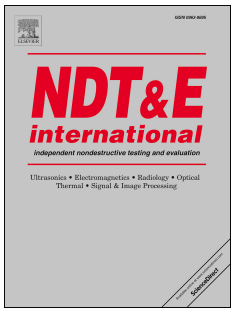

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High-Selectivity Imaging of Closed Cracks in a Coarse-Grained Stainless Steel by Nonlinear Ultrasonic Phased Array

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In measuring crack depths by ultrasonic testing, there are two difficulties; crack closure and coarse grains. Crack closure can cause the underestimation or miss-detection. Coarse grains can hide crack tip responses due to strong linear scatterings at coarse grains. To solve these problems, a combination of a crack opening method, global preheating and local cooling (GPLC) and a high-selectivity imaging method, load difference phased array (LDPA) was proposed. However, it has yet to be verified. Here we formed a tightly closed fatigue crack in a coarse-grained stainless-steel specimen using a stepwise-decremental method. In the specimen, we demonstrated that our method is useful in selectively imaging closed cracks in coarse-grained materials.

Keywords: Nonlinear ultrasonic phased array, closed cracks, coarse-grained stainless steel, thermal stress

1. Introduction

In nuclear power plants, crack depth is one of the most important factors that determine material strength. Hence, the accurate measurement of crack depth is essential for ensuring the safety and reliability of aged structures and materials. To measure crack depths, ultrasonic testing (UT) is the most