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Quantitative Imaging Evaluation of Stainless Steel Defects by Lock-in Infrared Thermography

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Abstract:

Infrared thermography deals with the acquisition and analysis of thermal information from non-contact, fast speed thermal imaging devices. In this paper, we proposed to investigate the capacity of lock-in infrared thermography technique for the quantitative evaluation of subsurface defects in a stainless-steel sample. A square shaped sample with dimensions 180 mm × 180 mm and artificial defects of round cutouts with varying size and depth was considered for the analysis. The experiment was done at several excitation frequencies to investigate the sample and the effects of each excitation frequency on defect detachability. The four-point method was used in post processing of every pixel of thermal images using the MATLAB. An excitation frequency of 0.01 Hz was experimentally determined to provide the strongest phase contrast response for defects in steel plate investigated. The inquiry with the effect of defect size and depth on phase contrast shows that the phase contrast decreased with increasing defect depth and decreased with the increasing defect size. The phase image gives a prominent description of the defects which are not visible in the captured image sequence.