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ABSTRACT

PRESENTATION

PAPER

Julien Lecompagnon is a researcher (tenured) at the Federal Institute for Materials Research and Testing (BAM) in Berlin, Germany.

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PRACTICAL STUDY ON THE THERMOGRAPHIC DETECTABILITY OF INTERNAL DEFECTS USING TEMPORALLY STRUCTURED LASER HEATING

Modern laser systems have proven to be versatile heat sources for active thermographic testing applications. Compared to more traditional light sources, e.g. flash or halogen lamps, their output power can be easily modulated at high rates, allowing a wide variety of complex excitations to be realized. Although their total optical output power can be theoretically scaled to arbitrary values, the maximum output power is practically limited by many factors: the maximum power that the sample under test can absorb without altering the lighted surface itself, the trade-off between power density and inspected area, the cost of the laser system, etc. Furthermore, when working with spatial modulator systems, the output power could be limited to avoid provoking any damages on such devices. Nevertheless, to guarantee sufficient heating even for highly thermally conductive materials and/or deeply buried defects, the heating times can be extended, e.g., either by using step heating, long pulse thermography, or by lock-in thermography with a continuously modulated heating. However, for all these approaches, the ranging capabilities of the thermographic defect detection are reduced due to the limited frequency content of the excitation.

To tackle this problem, i.e. to increase the excitation energy while preserving its frequency content, new approaches have been developed in the last two decades, among which the use of coded excitations combined with pulse-compression, and the use of multiple lock-in analysis or of a frequency modulated excitation signal. The challenges of such temporally structured heating techniques are manifold, for example, the DC component inherent in optical heating must be taken into account. In general, a wider frequency bandwidth or greater variability of the frequency components also means greater complexity for signal generation and data processing. In this paper, temporal structured excitation schemes with different degrees of complexity are compared on a high power laser system.