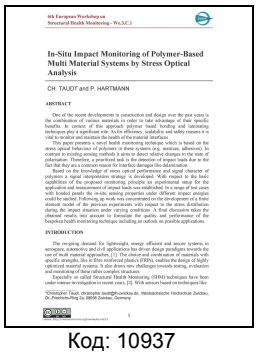

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# In-Situ Impact Monitoring of Polymer-Based Multi Material Systems by Stress Optical Analysis

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One of the recent developments in construction and design over the past years is the combination of various materials in order to take advantage of their specific benefits. In context of this approach polymer based bonding and laminating techniques play a significant role. As for efficiency, scalability and safety reasons it is vital to monitor and maintain the health of the material interfaces.

This paper presents a novel health monitoring technique which is based on the stress optical behaviour of polymers in these systems (e.g. matrices, adhesives). In contrast to existing sensing methods it aims to detect relative changes in the state of polarisation. Therefore, a prioritized task is the detection of impact loads due to the fact that they are a common reason for interface damages like delamination.

Based on the knowledge of stress optical performance and signal character of polymers a signal interpretation strategy is developed. With respect to the basic capabilities of the proposed monitoring principle an experimental setup for the application and measurement of impact loads was established. In a range of test cases with bonded panels the in-situ sensing properties under different impact energies could be studied. Following up work was concentrated on the development of a finite element model of the previous experiments with respect to the stress distribution during the impact situation under varying conditions. A final discussion takes the obtained results into account to formulate the quality and performance of the bespoken health monitoring technique including an outlook on possible applications.

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**Ключевые слова:**

**Содержание**