

1.7.10. ACOUSTIC EMISSION DIAGNOSING OF BRITTLE FRACTURE IN STRUCTURAL MATERIALS

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The obtained results of theoretical and experimental investigation are aimed on solving important scientific and technical problem, namely, on formation of methodological ground for acoustic emission diagnosing of fracture processes in long-term service structures.

A model and methodological approaches for estimation of fracture type in solids is developed. The fields of elastic waves emitted during dynamic local variation of material structure, especially caused by crack-like defects in structural materials, are the target of the research.

Using the proposed model considering the features of formation and propagation of micro- and macro-cracks in structural materials, which accompanied by generation of elastic waves of acoustic emission (AE), the quantitative characteristics of most stable AE parameters are determined. The logical sequence for obtaining the criterion parameter ζ is proposed. Application of this parameter allowed us to establish the criterion for estimation of brittle fracture by AE parameters.

For verification of the established criterion the facilities providing measurement of the AE signals parameters with minimum distortion of their shape and amplitude-frequency response are proposed. The developed and fabricated after numerous tests the portable eight-channel measuring AE-system SKOP-8 having the certificate of measurement was used in the experiments aimed to confirm the criterion for estimation of brittle fracture.

The results of research of various structural materials allowed us to systematize the features and quantitative parameters of variation of the AE signals amplitudes, width of their frequency spectrum, and rise time pulses depending on propagation distance of the elastic AE waves in material and taking into account the modes of AE signals selection and transformation. On this basis the methodical recommendations for conducting AE diagnostics of structures and their elements with the use of AE system SKOP-8 were elaborated. Their application at industrial objects has confirmed high efficiency of the proposed criterion, the methods of its application, and facilities for selecting, recording and processing of AE signals.