

Regularities of Changes in the Fractal Dimension of Acoustic Emission Signals in the Stages Close to the Destruction of Structural Materials When Exposed to Low-Cycle Loaded

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Abstract : The article deals with theoretical problems of correlation of processes of microstructure changes of structural materials under cyclic loading and acoustic emission. The ways of the evolution of a microstructure under the influence of cyclic loading are shown depending on the structure of the initial crystal structure of the material. The spectra of the frequency characteristics of acoustic emission signals are experimentally obtained when testing titanium samples for cyclic loads. Changes in the fractal dimension of the acoustic emission signals in the selected frequency bands during the evolution of the microstructure of structural materials from the action of cyclic loads, as well as in the destruction of samples, are studied. The experimental samples were made of VT-20 structural material widely used in aircraft and rocket engineering. The article shows the striving of structural materials for synergistic stability and reduction of the fractal dimension of acoustic emission signals, in accordance with the degradation of the microstructure, which occurs as a result of fatigue processes from the action of low cycle loads. As a result of the research, the frequency range of acoustic emission signals of 100-270 kHz is determined, in which the fractal dimension of the signals, it is possible to most reliably predict the durability of structural materials.

Keywords : cyclic loadings, material structure changing, acoustic emission, fractal dimension

Conference Title : ICASMS 2018 : International Conference on Aircraft Structures and Mechanical Systems

Conference Location : New York, United States

Conference Dates : June 03-04, 2018