INVESTIGATION OF THE DESTRUCTION OF FURANO-EPOXY COMPOSITES WITHIN THE FRAMEWORK OF FRACTAL GEOMETRY

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The destruction of furano-epoxy composites is due to the identification of fundamental parameters between micro- and macroparameters of fracture based on the combination of synergetics, fractal theory and fracture mechanics. A feature of the destruction of composites is its discrete character with respect to time and space of destruction and strength, which are of statistical nature. Destruction depends on the structure, size and configuration of a composite, the nature of the external environment as well as the type of load. The statistical nature of destruction is due to two factors: the influence of fluctuations, randomnesses in the location and size of crack-like defects. The first reason is microscopic, the second is macroscopic. In evaluating the relationships between the characteristics of a fracture at micro and macro levels, which are determined by statistical nature of the destruction of composites and the influence of fluctuations on the process of destruction of furano-epoxy material, it is advisable to apply data on fractals and synergetics. The object of the study was a furano-epoxy composite based on FAED-50 (20), quartz sand, aminophenol hardener Agidola AF-2. The main deformation-strength properties of composites have been investigated. The parameters which have been analyzed are fractal dimension, the value of the percolation threshold parameter, statistical characteristics of the destruction process of composites. The number of microcracks with an average radius in the composite under load and critical tensile stress (MPa), has been calculated from Griffith's theory $\sigma_c \simeq 5 \cdot E/6$, where E, the modulus of elasticity, (MPa), has been determined from the ratio at: $N_f = \to N$: $N_f = 4 \cdot \sigma^2 / \pi \cdot r^2 \cdot \sigma_c^2$ .At optimum technological parameters of molding products the size of defects in composites is equal to 10 - 15 microns.

The critical concentration of cracks (the number of pores, cracks, etc. per volume unit) that determines the strength of the system as a whole is estimated taking into account the relative rms deviation of the parameter: experimentally for two and three-dimensional space $C = 0,54$; $d -$; the dimensionality of space; $l -$ index of the correlation radius (for two - dimensional space $l = 1,33$, three – dimensional $l = 0,8 - 0,9$): $N_m = [C/W]^{ld}$). The relationship between N_m and the lattice period A- is determined by the dependence: $N_m = [L/A]^d$ „ where $L -$ the size of the system, m (under experimental conditions $L = 10^{-2}$ m).

The analysis of the data suggests that despite the fact that the number of microcracks and microdefects in composites before destruction is large (tens of thousands), their strength is determined by several tens of large accumulations of microcracks (focal destruction zones), i.e. there is a strong localization of accumulations with the formation of clusters. Large focal zones (clusters) are formed when the concentration criterion for microcracks is met, i.e. to form a small number of large clusters, it is necessary to have a lot of microcracks. Discrete phenomena in the mechanics of the destruction of composites from the standpoint of synergetics are due to the presence of fracture self-organization under various types of load, and they are manifested at the macrolevel by powerful collective processes of transformation of the significant part of the fractal structure.