Use Of Stochastic Methods For Treatment Of Cyclic Random Processes Of Multiple Cracking

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Abstract - **New methods for treatment of significant amounts of data on nucleation and coalescence of defects were developed. The analysis of the surface condition of modern nanocoated materials was performed.**

Keywords – **computer analysis, damageability assessment, complex mathematical processing**

I. INTRODUCTION

Contemporary approaches to the mathematical treatment of data on multiple cracking of materials allow determining the orderliness of crack-like defects. The condition of the object of research can be evaluated numerically, taking into account the effect of loading parameters. This work is dedicated to the stochastic methods for treatment of cyclic random processes, which aid in the multiple cracking analysis.

II. MATHEMATICAL PROCESSING OF EXPERIMENTAL DATA

With a view to analysing multiple cracking of the zirconium nanocoating the stochastic methods for treatment of cyclic processes were used [1]. At first, the discrete rhythm function was formed by dividing realisations into segments (cycles) in order to obtain a zonal-spatial structure of the signal (lengths of sections between cracks), Fig. 1.

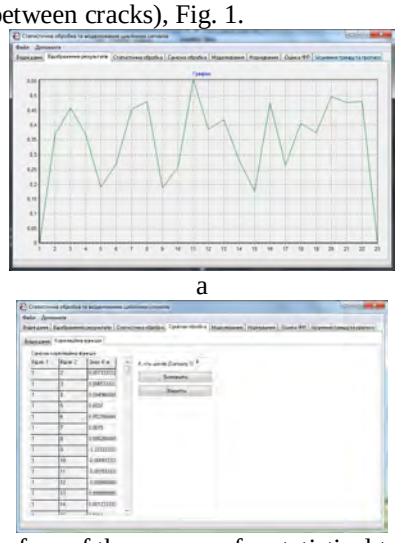

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Fig.1. Interface of the program for statistical treatment of multiple cracking

Using the mathematical model and statistical processing methods the algorithm and software were developed, which allow investigating multiple cracking by obtaining the multiple cracking parameters. The mathematical model of the cyclic random process of cracking and the relevant treatment methods allow conceiving the ideology of the complex approach to predicting the nanocoating damageability based on provisions of the theory of plasticity, physical mesomechanics and statistical treatment of cyclic processes.

The main regularities in the nanocoating fragmentation are found based on the cyclic process model, which allows obtaining the informative features describing the mathematical expectation, dispersion and autocorrelation function (taking into account the rhythm function of multiple cracking). The probability characteristics of the nanocoating cracking can be used as informative features relevant to the damageability parameters of the "steel-coating" system. The derived ultimate values of cracking parameters [2] are confirmed by the experimental results obtained by using the transmission microscopy and 3D profilometry. The maximum fragmentation of the coating surface is found to occur in the zones where deformation fields overlay by the "compression+shear" scheme.

III. CONCLUSION

The morphology of cavity formation in the zones of material tensioning allows for a rough estimation of the stress-strain state of the surface fragments analysed.

The presence of the strain localisation zones testifies to the compensated nature of the material deformation at the macrolevel. It is established that the multiple cracking structure of a coating is formed under a significant effect of deformation processes in the base, i.e. it is a response to shears and displacements of the base.

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