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POSSIBLE STATES OF THE DETERMINISTIC MODULAR STRUCTURES WITH CRYSTAL, NANO-DIMENSIONAL AND FRACTAL COMPONENTS IN ANTIFRICTION COMPOSITIONAL COATINGS

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Abstract - The possible classes of states of the modular structures with crystal, nano-dimensional and fractal components in antifriction compositional coatings were discussed.

Keywords: structural state, nano-dimensional component, nanostructure, fractal structure, compositional coating.

The structural states forming from nano-dimensional n, fractal f and crystal r components with account of the qualities of the corresponding nano-objects set into 3D space were analyzed [1 - 3]. The possible structural states into 1D space are may be combinatorial enumerated and presented by next square matrix A

$$A^{(1D)} = \begin{Vmatrix} r & n_r & f_r \\ r_n & n & f_n \\ r_f & n_f & f \end{Vmatrix} = \|a_{ij}\|,$$

where the states r, r_n and r_f are denotes the crystal of atoms, the crystal of nano-objects and the crystal of local fractals, the symbols n, n_r and n_f are denotes the nano-object only, nano-objects with crystal and fractal structures, the symbols f, f_r and f_n are denotes the fractal only, fractal with crystal structure and fractal of nano-objects, accordingly.

Square matrix of the possible states $A^{(3D)} = \|a_{ij}\|a_{ij}\|a_{ij}\|\|\|\|$ contains in all $N = 3^{2d} = 729$ states with different orientation. The possible classes of structures with nano-dimensional, crystal or fractal components are may be presented.

1 Class nano-dimensional (n n n) is contains the R_{nnn}^3 structures from 3D-nanoparticles to 3D local fractals.

2 Class nano-dimensional crystal (r n n) is contains the R_{rnn}^3 structures from 3D structure of ordered 2D nano-particles to 3D structure of 2D local fractals ordered after fractal law into 1D.

3 Class nano-dimensional fractal (n n f) = (n f n) is contains the R_{nfn}^3 structures from 3D structure of 2D nano-objects ordered after fractal law into 1D space to 3D structure of 1D deterministic fractals and 2D local fractals.

4 Class nano-dimensional fractal hybrid (n f f) is contains the R_{nff}^3 structures from 3D nanostructure of 2D fractal hybrid structure to 3D nano-fractal of 2D fractal nano-objects.

5 Class crystal fractal nano-dimensional (r f n) is contains the R_{rfn}^3 structures from 3D fractal structure of ordered nano-objects to 3D structure of 1D deterministic fractals and 1D local fractals ordered after fractal law into 1D space.

6 Class crystal nano-dimensional (r r n) is contains the R_{rrn}^3 structures from 3D structure of ordered chains of nano-objects into 2D space to 3D structure of fractal nano-objects ordered after fractal law into 2D space.

7 Class crystal (r r r) is contains the R_{rrr}^3 structures from 3D-crystal of atomic chains to 3D- crystal of local 3D fractals.

8 Class crystal fractal (r r f) is contains the R_{rrf}^3 structures from 3D structures of ordered in 2D space 1D fractals to 3D structures of local 3D fractals ordered after fractal nano-objects law into 1D space.

9 Class crystal fractal hybrid (r f f) is contains the R_{rff}^3 structures from 3D structures of ordered 2D hybrid fractal to 3D structures of 2D fractal nano-objects ordered after fractal law into 1D space.

10 Class fractal hybrid (f f f) is contains the R_{fff}^3 structures from 3D fractal hybrid structures to 3D fractal nano-objects.

These results were used for theoretical modeling and interpretation of tribologic surface properties of the compositional coatings based Ni-P and Ni-B systems [4-8].

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