СТРОИТЕЛЬНЫЕ МАТЕРИАЛЫ И ИЗДЕЛИЯ

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G. P. DOROSHKO

CONDITIONS OF DISCRETE CONVERGENCE OF STRUCTURES SYNTHESIS MODELS IN METAL AND NON-METALS COMPOSITIONS

УСЛОВИЯ ДИСКРЕТНОЙ СХОДИМОСТИ МОДЕЛЕЙ СИНТЕЗА СТРУКТУР В КОМПОЗИЦИЯХ МЕТАЛЛОВ И НЕМЕТАЛЛОВ

The set-theoretical convergence of models of continuous and discrete synthesis processes in the compositions of metals and non-metals at the action of ray sources is shown. The non-metal density function obtained by the IDS thermal impulses on the temperature axis projection has a periodic view with fixed stationary temperatures. They coincide with the boundaries of different areas of change in the speeds of metal heating. This convergence of models to the general periodic operator is possible under four conditions of beam scanning: separation, compactness, property of states, stability. Then the current reciprocity ratios of the system (metals/non-metals) allow the use of the temperature of stationary non-metals as support for metals and serves to determine the parameters of ray sources when synthesizing structures in the compositions of the volume of the material.

Keywords: *Set theory, substance scanning, temperature analysis, discreteness principle, modeling structures, layer synthesis, metals and non-metals compositions*

Показана теоретико-множественная сходимость моделей непрерывных и дискретных процессов синтеза в композициях металлов и неметаллов при действии лучевых источников. Функция плотности элементов объёма неметаллов, полученная тепловыми импульсами ИДС на проекции оси температур, имеет периодический вид с фиксированными температурами стационарности состояний. Они совпадают с границами различных участков изменения скоростей нагрева металлов. Такая сходимость моделей к общему оператору периодичности возможна при выполнении четырех условий лучевого сканирования: раздельности, компактности, собственности состояний, устойчивости. Тогда действующие соотношения взаимности системы {металлы/неметаллы} позволяют использовать температуры стационарных состояний неметаллов в качестве опорных для металлов и служат определению параметров лучевых источников при синтезе структур в композициях объёма материала.

Ключевые слова: *теория множеств, сканирование веществ, температурный анализ, принцип дискретности, моделирование структур, синтез слоя, композиции металлов и не металлов*

Introduction

Simulation of the effects of ray sources is a promising method for developing control programs for technologies for producing products of complex shapes from metal powders and also serves to search for new methods of synthesizing substances [1]. The already existing mathematical apparatus for describing processes in metals Me can be used to obtain products from non-metals ⌐M (including M^+ – molecular forms), if you combine it with the scan-derived data lows [2–8]. It is possible to introduce an energy order relation for non-metals in addition to the applied chemical systematization.

Information about non-metals is presented by topology methods of state diagrams. The developed complex analysis of relations in the system {Me, ⌐M} provides, in addition to the principle of continuity, the principle of discreteness, which is implemented as a scanning method – MS, its potential is known in technology [1, 2, 6]. However, as a method of MS analysis remained unexplored [7–9]. The main reason is that in combination with other methods, probability remains as a measure of description. Therefore, at first, the work was done to complete enumeration of unknowns was performed, new properties of parametric diagrams and coordinates of stationarity were determined [8, 10]. Taking advantage of the MS, unrestrictedly setting the function of influence, the boundaries of belonging to classes are indicated and the mechanics of the principle of combination is shown [10].

The main property of scanning diagrams is the fact that the selected neighborhoods of the density points are not shifted, their stationarity and periodicity relative to the temperature axis [7, 8, 10]. The practice of temperature analysis applications of $T_{м}A$ temperature analysis has shown that there are always facts of unbiasedness effects for substances if graphs and tables of temperature dependence. And where they were not observed, they were also found in the subsequent when changing the parameters and refining, therefore they are called simplified stationary T_{π}.

According to the $T_{м}A$ theory, the branches of the density distributions of the structural elements of the volume over the overlapping intervals are joined to minimize the entropy by achieving the maximum adhesion strength $fi + fj$ while reducing the thickness of the interphase -if of the interlayer ∂ij. The released heat from this zone lowers the temperature at the contact of the structures, contributing to min ∂ij and ΔQ / $\Delta T \rightarrow + \min \Delta S$, the number of admissible states decreases with an overall increase in entropy over all intervals $\Delta T\pi$.

The temperature of the particles at the borders is not equal to the phase transition temperature, and a thermodynamic substantiation of the fact of the existing compatibility of the grids is required based on the principle of detailed equilibrium, as was done when *L*. Onsager explained the reciprocity relationship. The purpose of the work is to determine the conditions for convergence in energy to the centers of formation of phase structures at the stationarity limit. The temperature of the particles at the is not equal to the temperature of the phase transition.

Theory to the problem of model convergence

Atoms of metals and non-metals as two subsets of the periodic system of Mendeleev-PSM represent an extensive family of substances already existing in nature with a very heterogeneous composition and properties. Metals as conductors of energies become the generators of derivatives of small forms of the phases of the structure of the volume of the body. In the models of synthesis technology processes, they are the result of the chemical interaction of the secondary activity of metals and the second stage of structural transformations.

The properties of substances have changed abruptly and it is believed that metals lose their qualities when surrounded by non-metals. However, modern thermodynamics shows something different – metals retain their trajectories, in the space of variables they do not intersect. Surrounded by non-metals, it is always possible to investigate the activity of metals by placing them at the origin of structure formation as atoms of the former.

The way the activity develops and decays with the rupture of states, with the formation of new phases, serves to determine the convergence when depicting the compatibility of substances in a composition on diagrams. The Onsager reciprocity relationship matrices $Lij = Lji$ written in the structure of the volume with the dimensions of the neighborhoods show convergence to stable complete structures of local phases and become determinable by methods of physicochemical analysis at the limit of countability of the Me ± ⌐M ratios.

The convergence of two representations for the physical system {metals ↔ non-metals} is possible due to the relationship of its own processes with respect to energy changes as two grids of one topological space – I given by points and structures. The vector of change in the sequence of functions of phenomenological models I is directed to the infinitesimal one. In structural models, the vector to them is orthogonal by stability; in the limit, this section of trajectories and the model of changes in structures is defined as a sequence of operators.

For completeness of the coverage, data on two areas are required. If the parameters relate to the thermodynamic zone *E* of the processes, the formalism describes the properties that do not depend on the composition of the substance, and then the second region, kinetics, receives an additional factor of certainty [8, 9]. A lot of information has been collected on the kinetics of non-metals, however, in the field of thermodynamic parameters, the limiting application of the local theory of equilibrium is the difficulty of directly tracking the dynamics of structural changes {structures C_s $\rightarrow$ composition C_c}, where C is common basis [7]. Application of the method of temperature analysis – TMA in this case proceeds from the fact that the non-metal ⌐M – metal in the grid of operators of adhesion Ō and detachment Ŏ of the action of the general ring operator Õ. The volume elements are formed by achieving local completions of the transformations of the structures of the phases corresponding (homeomorphic) to the structure of the space of the total activity E of the atoms Õ (E).

Self-consistency of eigenstates is possible in local volumes, if a single measure of energy exchange is established, ending with a common step of structural transformations.

$$\tilde{O}(E) = \breve{O} + \bar{O}. \quad (1)$$

Representative for determining the measure of the structural limits of the base of compositions are studies of $\{C_c \to C_p\}$ temperature transformations of the three-element system {Fe-Al-Si}, in the cycles {Me-Õ-M} of oxidation and reduction (Me ↔ ⌐M), i.e., system: {Fe-Al-Si} ↔ {(Fe + O) – (Al + O) – (Si + O)}. The search for the metric was carried out by the method of stratifying complex systems into simple ones, operation inverse to alignment [9,10].

The discrete basis refers to the existing model for metals as an atomic group of compositions, focused on the periodic table of elements of the PSM. The limiting molecular system – clays of dissimilar composition, structure, grain size, is also oriented towards PSM. From a single source $PSM \to$ grids are stable along the observed phase boundaries and the vicinity of the stationarity response [8, 11]. The inhomogeneity in the volume outside of the phase locals remains undefined.

By the methods of theoretical physics, the number of particles in the volume is calculated on the assumption that the size of the phases is unlimited, the specificity of their surface is not taken into account [12]. The phenomenal logic of the apparatus with probability as a measure is represented by the ratio of the observed events n to the entire background N of unobservable ones $P\rho = n / N$. However, if we consider it as a ratio of limited to unbounded systems, metric spaces including non-metric ones, then the limit of such ratios expresses the density of substances ϱ and it can be used to assess states by the balance of data from discrete and continuous studies.

$$P_\rho = \{n/N\} \to \{m/V\} = \rho. \quad (2)$$

The convergence to the elements of the PSM is described by the distributions of the physical densities of a set of specific compositions, observing the requirement: the action is minimal if no element of the volume (with its structure) is generated by others. The action function is set without changing, observing strictly isoparametric conditions ↓T in energy (temperature) and its amount t (time), then the response trajectory is similar to the section of the volume of the configuration S and is a display of data consistent with the structure. But if it is not the function by the property ↑ϒi that is investigated but the fact of the morphism Si of volume, the mapping into itself of the eigenstate of matter $\Upsilon(\mu)$ of the composition potential μ determines the parameters of the volume with differentiation Sn. Then the general equation of changes in volume includes equilibrium and nonequilibrium configurations.

$$\downarrow(S \cdot T \cdot t) = \uparrow S_i \Upsilon_i + S_n \Upsilon(\mu). \quad (3)$$

Equation (3) is solved if, when searching for the topology limit by the method of difference schemes, we separately consider discrete systems as finite, consisting of complete elements of structures, and they are infinitely changing in energy. Then there is a simplification, Banach lattices of bounded given metals and non-metals have T × t → 1 strong unit, tied to the volume through the physical density, the fact of the held probability (2). Or, in other words, the metric normalized to integers cannot be fractional. However, the non-equilibrium stage (3) of the process is uncertain and such regulation cannot apply to it. That, that for metals the nonequilibrium part of the volume is occupied by a continuous electron gas, and for non-metals such a gas is the same as a discontinuity of monotony, uniting both formal spaces. The unit has a physical nature, and all equations are pairs of the space $I = If + Ii$ it but I for the convergence of Me and ⌐M are dependent as $I(E)$ and $I(T)$.

The volume V of metals is represented by the n-dimensional zone Vi with the border Γi of the parameter l, the set of points with a linear mesh $V(l) = V(li) + \Gamma(li)$. The parameter l characterizes the density of the grid and for $|li| \to 0$ a sequence of n-dimensional regions Vi fills the entire volume V since beyond the phase boundary e-dimension (electron gas) belongs to the next more subtle order. Mesh of non-metals for the initial conditions of nonequilibrium $|li| \to$ min. Each region $V(li)$ has a separate composition, changes due to G (li) which is not equal to zero, since it is represented by atomic (A) volume. Discrete data for this part retain the significance of A-dimensions of the real mass and cannot be excluded at the limit as an error. For a grid of non-metals, the dimensionality of the density with the operator of the entire volume $L\rho$ is also the sum of the dimension greater than for the electron gas $L = 10^3 l$.

$$L_\rho V_l = L\rho_V + L\rho_\Gamma. \quad (4)$$

In this case, the second term of the equation related to the boundaries is nonlinear. It is known that with an increase in the size of the sample and the number of particles in it, surface effects grow much more slowly than bulk effects [12]. By writing the layer as a volume element, translates the orthogonal coordinate, normalized to unity in physical in the transition to the definition of the chemistry of phases and observance of the fact of the duality of the structure of substances.

$$V = V_v + V_{\underset{\to}{s}} \text{ or } V = V_{fi} + V_{\underset{\to}{if}}. \quad (5)$$

V_{fi} is the volume of the phase, V_{if} is the volume of the interphase. Monte Carnot modeling has limits, but gives good convergence of models if the layer thickness exceeds a certain minimum value [14]. It is larger in size of the interphase, and is quite measurable in the diagrams.

$$|l_i| \to \text{const} = l_\pi. \tag{6}$$

The limiting width of the neighborhood lπ, which is also related to the contact zone of the phases, changes decreasing to nanodimensional values, the fact of technological optimization of layer-by-layer synthesis and compliance with the theory of discrete convergence. It considers separately the grid functions (or numeric scan sequences), and operators (or volume section configurations). Sequences of functions *Me* and ¬*M*:

– firstly, they discretely converge to someone value if the sequence differences tend to zero. But since this is related to finite systems of structures, such a difference is the limit of the tendency to the boundary of the rupture of the structures of phases or junction (5). This condition is the justification for the reliability of one-step heating or confidence in the significance of one point – the series has only one limit.

– secondly, the sequence is discretely compact, converges if the variability of configurations is infinite. Assuming an unlimited change in temperatures, there is always a certain final structure-phase, to which the sequence converges. Phases *M* + form rows of C_c inhomogeneous sequences, reducible to each phase Cc as local limits. This is already an expansion in a series of temperatures, so that the balance of nonlinearity and linearity over the intervals ends with a minimum of entropy due to the boundaries. For *T*, this is the unbiasedness or stationarity of T_π, therefore the boundaries of states (4), (5) remain, but stationarity is possible if these temperatures are periodic, i. e. coincide with an accuracy up to unity of the norm of the boundaries – atom/e → periodicity of the *PSM*. Any stationary sequence converges and sequences of sequences also converge. The grid sequence of operators for determining the contact structures of the interphase has four convergence conditions:

1. Operators, systems of connecting mappings {*Me* Õ ⌐*M*} converge discretely if there is convergence of data to a general operator – Õ, which does not change the operating models for some data sample. The models used are valid for non-metals [1, 2, 6]. Does not depend on the type of beam, laser or electronic, the question of order is $E\sum = E\varphi + Ee$, $E\varphi$ – photon energy, Ee – particle energy.

2. The sequence converges compactly if its norm for metals is less than or equal to a constant, is preserved when normalizing the temperature series for non-metals. If it were not for the established fact of the stationarity of the period in *T*, this condition obliges him to introduce it.

3. Actually, a sequence converges to an operator if there is a reciprocity of compacta, i. e. if the rate of a constant is a confidence level for non-metals, then it is also a confidence rate for metals. The rationale for such a unity of the norm is outside the measurement data – statistical physics, it is common for metals and non-metals [11]. Stationary state temperatures, the reciprocity relations obtained by scanning non-metals are also valid for metals. Emission and absorption are determined by the range ΔT_π, in which energy exchange occurs, depends on the frequency distribution in them.

4. The sequence converges steadily if the general operator exists in a normalized manner and, upon a more detailed examination, the data changes are less than the established constant. The areas for determining the confidence of the operator coincide in detail for metal and non-metal in the selected interval, in this case, temperatures. The process model is valid for the action of an electron beam, laser pulse and heat pulse at the level of quantum exchange. The operator Õ (1) is valid for $\tilde{O}^{-1}$. Between two integer values of the description of structures, the fractional ones are taken into account already as the *SI* dimensions of the {electron / photon} system. The definition of *lπ* is tied to the interval by the inverse degree, the thickness of the layer also has a degree of 1/2 (Lamé-Clapeyron), the extraction operation when searching for the invariant of structures by ΔT_π, not only the movement of the layer, but also the change in the thickness of the interphase if.

$$l\pi = \tilde{O}^{-1}(\Delta T_\pi). \tag{7}$$

The stationarity of the states and the unbiasedness of Tπ for the phase trajectory is possible at the end points of the cycles of the ray fusion process. The invariant Tπ on the trajectory looks the same as the period of dividing the time scale during technology control. The chemical potential formula as a group operation for structural complexes also has a degree of ½ or $I^2 = -1$, and the norm of the topology of the two subspaces of the phases and the interphase has a minus sign indicating the movement of the surface in the direction of nanodimensionality, on which the metals of the structures give a response first [7].

The density in the equations of ray penetration into metals can serve as a measure if its temperature function is known [1]. Differentiation of masses $m = m(\rho, V)$, $dm = 1\ (\delta m / \delta\rho)\ V\, d\rho + 2\ (\delta m / \delta V)\ \rho\, dV$, shows the condition of the projections of the determinism of the scanning trajectory as two sections of the volume. Section at constant volume – combination of local mass changes, the ability to identify phase transformations by position in the coordinate system.

The second term in research introduces the average density of a constant as a characteristic of a substance [1, 2, 6]. Thermal conductivity is also the sum of two terms [1, 3–5]. Due to nonlinearity (3), it must be calculated from the density scan data, including the thermal conductivity of the interphase, which in the zone substantially depends on the coordinates of the phase contact.

$$\lambda = \lambda_{\phi i}(\rho) + \lambda_{i\phi}(T). \tag{8}$$

Here T is the temperature K of the expansion in a series in terms of the density of the phases forming the volume, i.e. structures with respect to the parameter *li* [9].

$$T = {}^{1}0{,}16 + {}^{2}1 + {}^{3}100 + N^{\circ}\Delta 343^{\circ}. \tag{9}$$

The physical nature of the digital elements of equation (9) is of particular importance – also the boundaries of the range graphics. № – number 1, 2, 3, 4, 5,… of period $\Delta T_{\pi} = 343$ – geometric constant of the finite nature of the forms of phase structures of a single-stage cut of the volume of matter, left and right ideal of stationarity with respect to the phase. 101,16K is the temperature of the first stationary state T_{π}, its previous changes are individual for each atom of the *PSM* refer to the cross section of the trajectories of atomic evolution, the distribution of a sample of 100 *PSM* elements, at this point the density corresponds to the chemical composition that heats up in the next interval. Index 1 to 0,16 (9) denotes the energy level of seven atoms. 1 – the first step of the structural combination, in which the position of one differs from the other six 1 → 6 i. e. the sum is saved = 7. 2 – seven elements is the primary unit = 1, one atom of the *PSM*. 3 – elements of the periodic system of *PSM*. Completeness sign for adjacent phases. If we use other sets 1 → 5 or 1 → 7, then volume fragments, left and right ideals of evolution trajectories are formed. Registration of the pulse power by such a breakdown is a great guarantee to achieve targeting at a point in the volume [15].

Equation (3) combines two sub-models, one of which includes specific anchor data determined experimentally. To measure the density values and then calculate the number of particles in the transition layer between them, the *IDS* method is used [7]. Scanning – short (sec) and narrow (m) exposure, it is necessary that the impulse corresponds to the size of the structure element. With *IDS*, the sample is less than the volume of exposure, the impulse can be very wide. Such heatstroke with *IDS* is no longer a Fourier gradient. Similarity of MS in the principle of execution and speed of shear action. The dimensionality of the elements of the volume structures of metals and non-metals covers two SM ranges from e--10-15m. to the size of the atom *Ai* -10-9m. Nano 10-9 10-12 m, interphase *Me* 10-12 – 10-15 and non-metal *M* + 10-9 – 10-12 m. If the beam has absorption characteristics it scans the heat effects Q in the substance. The reflection beam diagnoses the surface – the displacement function *L*. Two responses in *L* and *Q* and *IDS* are two possibilities for investigating relations or determining the functional of the fundamental pair $\{L \mid Q\}$ by solving the material science problem of finding the functions $C_s f_T C_p$ of the structural and composition $C_c f_t C_p$, according to the results of scanning the properties, C_p [16].

A-IDS – a way to search for the limit of numerical sequences by displacements L of experimental data by the method of temperature analysis $T_{м}A$. Method according to *Q* is the problem of already thermal analysis of determining the cycle time $t\pi$ by thermography methods. Combined – complex *W*-analysis. After iso-temperature treatment *A-IDS* samples $T \times t$ on a thermograph is heated with a rise along the beam $T(t)$.

W-IDS is a way to search for the limit of sequences of *CcÕL* operators in iso conditions [9]. With processing according to the method of temperature analysis for thermal, *X*-ray, etc. Obtaining complete information about substances.

When performing *A-IDS*, a laboratory furnace is used, placed on a hole in the frame with guides and a table entering the furnace from the bottom. Place one sample of the same size with the specified heat treatment step of 100 °C, in the next series the step is shorter, 50, 30 and 10 °C, etc. [8]. The oven is switched on to the thermostat mode at the set temperature, one sample "cold" by shearing is placed, kept and then removed in the same way. The oven temperature is raised to the next value. After cooling in air, the density is determined by one of the methods. The firing cycles are repeated until the entire diagram is plotted, keeping the sample size, mass composition, and holding time constant. In other series of heating, they change, maintaining the widest possible ranges of investigation, in order to determine the unbiasedness of the figurative surroundings.

The obtained *IDS* diagrams reflect the microstructure of the density macroproperty, representing it as local. This is a consequence of the properties of diagrams called unfolding [8]. The geometric nature of the locality of the mechanism is laid down in the order of scanning the volume by the condition of the constancy of the holding time, then these densities are a one-step cut. The first grain was processed at T_1 in time t_1, we got ρ_a, there is a point on the diagram, the second grain – at T_2, time t_2, ρ_b, the third sample, respectively: T_3, t_3, ρ_c. The time is the same in three cases, so at T_3 we first have a point a at T_1, it remains in the volume, then point *b*, at T_2, remains the same, finally, at T_3, the remainder of the density is c and it includes *a*, *b*, *c*, being distributed over the volume. If we continue, then further phase transitions occur {solid – liquid – gaseous} and obviously there is a limit – stationarity with a minimum of entropy. The appearance of a new phase of the volume element ensures the irreversibility of energy exchange.

In the considered initial model, metal powders are exposed to one electron-beam effect, this was one of the reasons for using this author's work to determine the convergence, in such cases there is no superposition of accompanying signals [1]. One-shot $\neg M$ firing and the primary beam response M_e are confident. This is especially necessary for non-metals, which have many phases in their structure.

In fig. 1 shows a part of the density scan points from the previously collected statistics, however, the approximation by the lines in fig. 2 showed that there was no need for the collection of statistics. And also, according to the first discrete convergence of numerical sequences of functions, one response value is sufficient.

Density lines are located correctly after a single exposure and their analysis is more reliable. The method of temperature analysis separates the projections of the two upper lines by placing them also relative to the time coordinate, not shown in the diagram [17].

Earlier, a formal correlation to the range of measurement systems was noticed [13]. Its strangeness in decimal multiplicity and in three measures of volume is 103, which in no way agrees with the accepted idea of the accuracy of calculations, the fractional nature of the digital recording of properties and the infinity of the limit. It is believed that the more decimal places the more accurate. This was specially investigated by the IDS method.

In fig. 3. shows the scanning of samples of different sizes at 850 and 1200 °C, the time is constant, fractional figures above the points – the fraction of the volume of raw material after cutting. The correlation to the metric range of the SI measurement system of multiplicity 103 is not so much that there is a jump effect in the mass region ¼ – 1/64, but that there is no jump effect for masses larger than 1/4. Moreover, the heating rate does not affect and the temperature rise to 1200 °C does not change the type of response.

The diagram in fig. 3 is not the usual functionality – it is a scan, from the surface to the depth, therefore the analysis is different, the effects at the beginning of the pulse, then the Fourier array and clean lines, discrete compactness, fig. 2. The size factor is significant by scanning at the beginning, when heat transfer occurs between the crystalline grains of the powder.

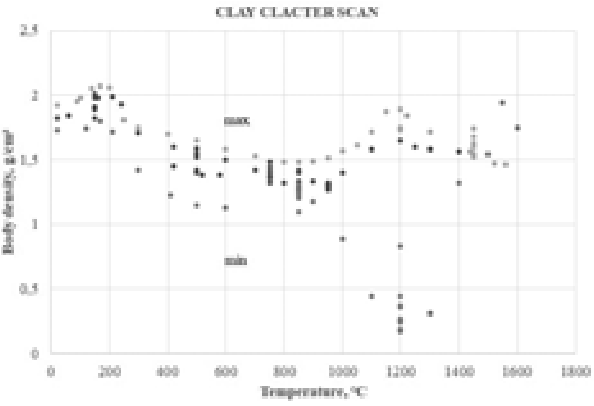

Fig. 1. Cluster of statistical processing
of data scanning of two clays

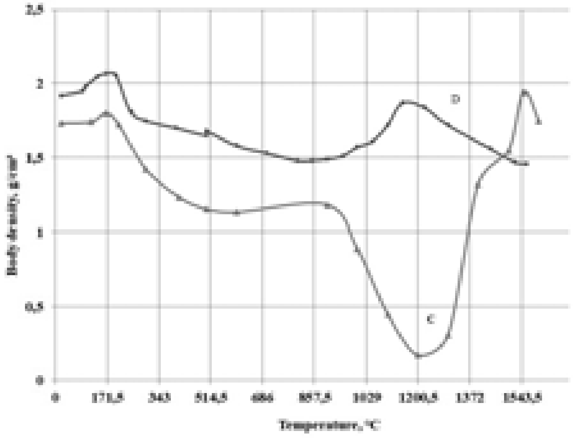

Fig. 2. A diagram of one-act scanning of clays

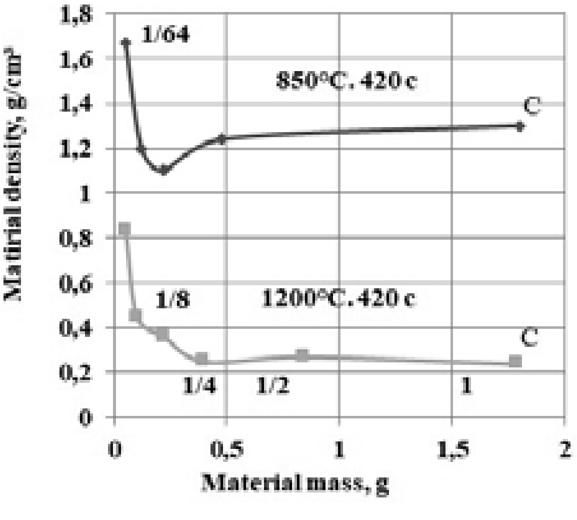

Fig. 3. Scan grains of different sizes
to estimate layered warming

Mesh convergence test results $\{M_e\} \leftrightarrow \{\neg M\}$

The solution of the Stefan problem gives the required depth of penetration of metals and the dynamics of temperature changes at the upper and lower boundaries of the powder layer, the left column of table1 [1]. Scanning of non-metals established the regularity of density redistribution and stationarity of states characteristic of the stability of a multiphase system, the right column of the table.1 [8, 9].

The joints of different sections of the heating rate change and the stationarity scan data have correspondences of individual temperatures, table 1. Taking into account that the temperature axis is not limited and is not tied to the composition of substances, the existing grid matches are considered reference in the ranges.

Table 1

Data grid convergence temperatures

Phase transition depth °C [1]	States stationary temperatures °C [6]
3234.8	3258.5
3200	
2817.5	2915.5
2435	2572.5
	2229.5
2052.5	
	1886.5
1670	
1636.7	
1603	
1570	1543.5
1475	
1380	
1285	
1190	1200.5
1095	
1000	
	857.5
	514.5
	171.5

The question whether they exist for metals according to the reciprocity condition has a positive answer, this is the third convergence of operators. There are already studies of aluminum and alloys for the data in the left column. A rough markup in the right column and a more accurate one oriented to phase transitions is a left column.

Confidence increases in each of the ranges of the overall grid. The accuracy of measuring stationarities in the right column of numbers is one degree, therefore, ± 1 appears in the interval in the form of 0.5 °C, and refers to the uncertainty of the width of the phase joints zone.

The coordinates of the centers of the phases and points of the vectors of the development of structures on the isosections are related to the composition of the substance and are determined from the diagrams in fig. 4 (taken from [15]) *Si* – *Si* + *O* (not applied) is located below *Al* – *Al* + *O*.

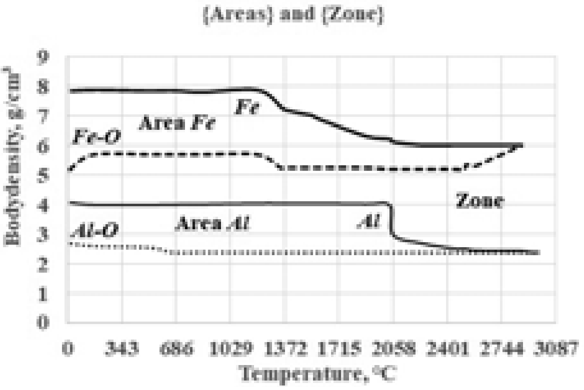

Fig. 4. Diagram "density – temperature" of the {*Fe-O-Al*} system

Cyclic lines show the areas a of coexistence of phases and the limits of the boundaries of the action of their chemical potentials. The zone z of contact in the gaps serves to restore the structures of the phases existing at the contact according to the data of the structures of the regions. The expected result of scanning of nonequilibrium states can be additionally estimated if the periodic grid (9) is plotted with the second coordinate as the limits of states that take place during heating from the periphery to the center. Having superimposed this grid, it is convenient to keep in mind as part of the process of transformations occurring in the depth of matter. This technique can be used in general when performing analysis when there are graphs of changes in properties relative to temperature.

Conclusions

1. The depth of the phase transition as the limit of the intrinsic process of structural transformations of an open system is determined by the chemical potential of the composition by closing 343 volume regions at stationarity temperatures.

2. The beam fusion model developed for metals is also applicable for non-metals if used: A. taking into account the temperature interval ΔTπ; B. in the formulas of effective thermal conductivity for non-metals, one term is considered as referring to the interphase; B. the density of substances is included as a variable, as determined from the IDS diagrams.

3. Isothermal discrete scanning and temperature analysis is an additional opportunity to search for a solution to the Stefan problem and for layer-by-layer control of the process of formation of interphase structures in Me-¬M compositions.

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About the author:

DOROSHKO Gennady P.
PhD in Engineering Science, Associate Professor of the Production of Building Materials, Products and Structures Chair
Samara State Technical University
Academy of Civil Engineering and Architecture
443100, Russia, Samara, Molodogvardeyskaya str., 244
E-mail: gen_dor@mail.ru

ДОРОШКО Геннадий Павлович
кандидат технических наук, доцент кафедры
производства строительных материалов
изделий и конструкций
Самарский государственный технический университет
Академия строительства и архитектуры
443100, Россия, Самара, ул. Молодогвардейская, 244
E mail: gen_dor@mail.ru

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