

tion of the RF fellowships of the RF leading scientific schools research governmental support many a time and oft. In 1982 the student body of the Department as part of the Perm Polytechnical Institute got the prize in the name of Leninist Komsomol for the research works. Annually not less than 15 best students of the Department are awarded with medals, diplomas and certificates of merit of the RF Ministry of Education on the results of the graduation papers contest, and also the diplomas for the reports at conferences. The Department students were granted individual scholarships of the RF President, titles of "Soros student, within the framework of the European Community "Commet" and "Erasmus" on the collaboration in the area of teaching and research the students, post-graduates and teachers of the Department completed their training and practical study at the Technical University of Vienna. Among the graduates of the Department there are leaders of enterprises and regional Administration.

The results of the accumulated practical experience, pedagogical and scientific activities of the Department's body are published in textbooks, 43 monographs, 27 learning guides. More than 50 new courses have been developed at the Department, 78 titles of study aids have been published.

Since 1970 a postgraduate study has been opened at the Department, and in 1991 – the doctoral studies on scientific specialties 05.16.06 "Powder metallurgy and composite materials" and 05.02.01 "Materials Science (industry)" were opened. Under the direction of the academician of the Russian Academy of Science V.N.Antsiferov 22 doctor's and 68 master's theses have been protected.

Thus, the academic process organization system at the Powder Materials Science Department, especially in senior courses, when the graduate performs research and developments under the leadership of highly qualified experts and teachers independently, working in the collective and realizing the responsibility for his work to it, together with the material remuneration and motivation to publishing his results allow forming not only the professional, but also learning-and-cognitive, informative and communicative competences in the graduate.

Since 2008 a new professional educational program of specialists training on the specialty 210605.65 "Nanomaterials" has been working at the Department. The accumulated experience of students' training will be a pledge of training highly qualified experts in the area of nanotechnologies and nanomaterials.

The work is submitted to the Scientific International Conference «Innovative Technology in Higher and Vocational Education», August, 2-9, 2008, Spain, came to the editorial office on 23.07.2008.

ROLE WHICH IS GIVEN TO THE STUDENT IN EDUCATIONAL SYSTEM

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Today in the modern press the problem of participation of the student in scientifically-educational process for which it and is developed at all is not shined. All publications reflect directions on which it is necessary to move, there is a search of ways of perfection of technology of teaching, science and education integration, attempts to make scientifically-educational process innovative and many other things are undertaken. Scientific researchers are not carried out in our country in the field of interrogation of students and schoolboys that give existing education to them, what lacks exist in educational process according to their representations, that in their opinion it is necessary to change in an education system. First, this area of research represents very important component, capable to find the best ways of creation of innovative scientifically-educational system; secondly, involves students to participation in working out of such program; Thirdly, forces young generation to think and develop as in power of thinking, and learns to reflect the thoughts in the verbal form; fourthly, it is scientific work for students who under the guidance of leading scientists can make questionnaires most prominent aspects of educational system; fifthly, this creation, on the basis of the deep analysis of existing educational programs and the relation to them of the basic consumer (his career: professional suitability, device possibility on specialties, scientific growth, conformity to requirements of customers already at an employment stage etc.) Concepts (which today in our country simply does not exist) capable to make scientifically-educational process innovative; sixthly, it is research work, training and career for a large quantity of sociologists, philosophers, psychologists and experts in other disciplines on the scale of all country at existing specificity of schools, high schools, educational systems etc. Thereupon for teachers disappears necessity: search within the precincts of educational institutions that of dissertations; preparations of pseudoscientific researches for career growth; to be broken off on performance of the basic work and carrying out of scientific researches (one in a damage of another). If the teacher aspires to give simultaneously a quality education and to raise the status in scientific activity creation of a feedback the student-teacher will be the best achievement of this purpose and. Self-development and perfection of pedagogical and scientific activity for both parties, adjustment of contacts, mutual understanding, appeal creation scientifically-educational programs and for teachers ability to light an audience to draw attention and to interest students to master a subject that should lay down in a basis of reports on the activity as the scientific work, allowing

to receive scientific degrees. As it is impossible to garble level of readiness of students in subjects of each separately taken teacher, scientific activity of already concrete teacher will be in direct dependence on indicators (not simply progress which can be manipulated) activity of students in scientific activity.

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POLITICAL SOCIALIZATION IN THE HIGHER MEDICAL EDUCATION

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The central concept of our researches is political socialization which is understood as a way of the person to finding civil outlook, comparison of the system of values to the certain vision of the state interest, influence on such identification of purposeful factors. Political socialization in high school as the party of a vital way of the developing person is space of a meeting (interaction, connection) official pedagogics (educational system), a policy (political traditions), concrete conditions of the biography of the separate person or the whole generation. Studying of so multi-plane subject as political socialization various generations, first of all, youth, demands the interdisciplinary approach. It presumes to answer the following basic questions: conducting approaches to of political socialization in a history and the modernity in various scientific directions; Historical experience of interaction of pedagogics, medicine and authority in practice of political socialization representatives of various ethnoses, faiths, regions, generations, floors in conditions of educational system of the higher school; optimum ways of studying political of socialization in a modern, polycultural society and development of recommendations on its perfection, including through interaction of pedagogical system of the higher school with the government.

The answer to the first item gives a panorama of various approaches to a problem, necessary for its three-dimensional consideration owing to integrated approach of an object of research. The answer to the second item can give representation about historical dynamics of pedagogical mechanisms of political socialization inside various educational levels and on their crossing. The answer to the third item will allow

$$x' = \Psi(x(t), z(t)), z(t) = \Phi(x(t), z(t)),$$

$$x(0) = x^0, z(0) = z^0 = \Phi(x^0, z^0),$$

(1)

where $t \in [0, T]$, $\Psi : G \subset R^n \rightarrow R^m$, $\Phi : G \subset R^n \rightarrow R^{n-m}$, $x(t) \in R^m$, $z(t) \in R^{n-m}$.

Combined numerical methods for solution (1): implicit Runge-Kutta's scheme with Newton's iterative Euler's scheme with simple iterations and

to offer new approaches to studying modern lines in of political socialization, those conditions and factors which define procedures of political socialization people from different generations at their meeting with the state. It is necessary for high school system to provide graduates, except for a professional knowledge and skills, skills to be guided in an escalating stream of the information, readiness for constant updating and updating of knowledge, and also ability to dialogue to interaction in collective, to the decision of disputed situations.

From these positions it is possible to believe, that - the manager in system of higher education it is necessary to include the following aspects in process of preparation of the medical sister: historical - a history of development of medicine and the general pathology; ethical - basic principles and concepts "is angry", "kindly", "validity", "conscience", "honesty"; legal - realization of key rules standard - legal certificates; medical - scientific validity, an estimation of a degree of risk, utility or uselessness, danger or safety for health and lives of the patient; psychological - models of interaction, psychological features of the medical worker and the patient; social - conformity to system of knowledge of norms and the values formulated in a society; religious - an admissibility of actions of the medical sister from positions of existing religious faiths; Educational - formation of valuable orientations in relation to the person of the examinee, to the own person, formation of the concept " I am a manager ".

Thus, the given approach allows to form the competent spiritual - moral person of the future medical the sister - manager, thus, to reduce negative consequences of use of new technologies both for separately taken person, and for a society as a whole.

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COMBINED METHODS OF NUMERICAL SOLUTION FOR ALGEBRA DIFFERENTIAL EQUATIONS

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We consider algebra - differential equations of the normal form and Cauchy problem [1] as follows:

tions are presented. It is shown convergence and exact numerical solutions.

Asymptotic properties of the both combined methods are discussed. We also give examples in which the numerical and the exact solutions are compared.

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LIFEWARE REALIZATION AS SITUATION OF SUCCESS IN EDUCATION

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The Russian society has been performing its life changes complex process focused on democratic transformations for the last years. Humanitarization of education is becoming an integral part of higher school renovation, is the means of students' panhuman culture formation. Most likely the new type of education will appear as a projective one called up to convert the culture in accord with those changes, which take place in the social development. The higher education quality is the key element, when creating the European Higher Education Zone. More than ever a further development of methods, approaches and criteria of quality assurance at all the levels (institutional, national, European) is necessary now. The quality as-

surance is the prime responsibility of higher educational institutions and it provides the basis for the academic community real responsibility. The training of specialists should be assured not only by the teacher's professional competency high level, but also by the conditions for the development of new educational technologies oriented to personality growth, the learner's peculiarities revelation, the acknowledgment of his subjective experience as originality and inherent worth, the composition of pedagogical effects with the agreement of individual and social experience. The entry of the human into the new development epoch, the change for the interaction with the help of global communications is attended by the realization of the fact that the outside world possesses simultaneously both the properties of integrity and multiplicity. In the constantly changing society the human is offered a wide range of choice, when solving professional and personal problems, that increases the degree of individual responsibility. Due to this the axiological, and it means – humanitarian, aspect of life grows.

The requirements made for the future specialists in conditions of the changes taking place in the society are, first of all, a high level of abilities to realize their intellectual possibilities, to use all their creative potential for displaying initiative and entrepreneurial spirit, solving problems in conditions of market economy harsh mechanisms. That is why the learner-centered education having the humanitarian aspect as the leading one, can create conditions for sound manifestation and development of personal functions of the educational process subjects, create the situation of learners' success.

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Short Report

**CONDITION CHANGE DYNAMICS AND
COMPETENCE STRUCTURE DIAGNOSTICS
OF FUTURE PHYSICAL EDUCATION
TEACHERS**

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Functional competence of future physical education teachers is considered as a part of their professional competence, characterized by mastering their main pedagogical functions (knowledge – ability – skills).

The problem is increasing future physical education teachers functional competence.

Actuality of the problem is the future physical education teachers professional physical education quality increasing process.

The object of the research is condition and functional competence of the future physical education teacher dynamics.

The subject of the research is condition and functional structure competence dynamics of the future physical education teachers (knowledge – ability – skills).

The purpose of the research is experimental study of the Kama state academy of physical culture, sports and tourism future physical education teachers condition and functional competence structure dynamics.

The task of the research is:

1. To analyze peculiarities of the future physical education teacher functional competence according to courses of study;
2. To conduct systematic – structural analysis of the Kama state academy of physical culture, sports and tourism future physical education teachers functional competence characters.
3. To reveal directions of the future physical education teachers functional competence formation process correction.
4. The methods used in research are:
 - a) Questionnaire
 - b) mathematics-statistical processing of the result.

The diagnostic instrument is a questionnaire «Portabe function diagnostics card of the physical education teachers» (Imashev, 1998) comprising 100 knowledge – ability – skills as functional elements of the 10 main physical education teachers pedagogical functions.

Organization of the research. 170 extra-mural fifth course students of the Kama state academy of physical culture, sports and tourism were offered to give information about their functional competence level according to the following rules:

– «zero» – no knowledge about the given functional element;

– «one» – there is knowledge about the given functional element;

– «two» – there is ability (the given functional element is used at least once);

– «three» – there is skill (the given functional element is used automatically).

The research is done from September 2004 up to June 2005.

The results of the research show that changing dynamics of the future physical education teachers functional competence is progressive: differences between future physical education teachers functional competence meanings are valid.

For revealing the system of structurally interconnected groups of functional competence influencing upon future physical education teachers general functional competence forming correlation factors between all functional competence meanings were found. They were formed into mutually connected matrixes, between main pedagogical functions and correlation pleiades were built.

Students of the first course have projecting pedagogical function with the most correlation factors meanings.

Students of the second course as system forming factor have constructive, projecting and mobilization pedagogical function.

Students of the third course don't have vivid system forming factor but a tendency of communicative, developing and mobilization pedagogical functions.

Students of the fourth course as system forming factors have the orientation – educative pedagogical function which correlates close to the constructive and projecting pedagogical functions.

Students of the fifth course have the tendency to the developing and mobilization pedagogical functions.

So, the hypothesis is completely confirmed:

1) dynamics of the Kama state academy of physical culture, sports and tourism extra-mural faculty future physical education teachers functional competence changing is progressive;

2) the basic of future physical education teacher functional competence forming process is projecting (1 course), constructive (2 course), mobilization (3 course), orientation (4 course) and developing (5 course) pedagogical functions which harmoniously coexist with other pedagogical functions in the correlation pleiad.

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Materials of Conferences

CORRELATION ENERGY OF DOUBLY EXCITED STATES OF HELIUM-LIKE ATOMS

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1. Selection and description of used approach

Main problem at calculation of multielectron atoms, which elementary case are helium-like atoms, eventually is the necessity to take into account of interaction between electrons. The review of approximate methods of the solution of this problem (as of 2000 year) it is possible to find in [1].

$$\psi = \psi_1 \cdot \psi_2, \quad (1)$$

where ψ_1 and ψ_2 - wave functions of separate electrons, which differ from hydrogen-like functions only by replacement in them of a real charge of the nucleus Z on effective charges Z_{e1} and Z_{e2} , which are variational parameters.

$$E_{\text{He1}} = \varepsilon_1 \cdot (Z_{e1}/n_1)^2 + \varepsilon_2 \cdot (Z_{e2}/n_2)^2, \quad (2)$$

where n_1 and n_2 - general quantum numbers of appropriate electrons, and ε_1 and ε_2 - factors, which take into account relativistic effects and influence of the nucleus. In the present work we have taken their value from experiment under the formula

$$\varepsilon = E_{\text{H exp}} \cdot (n/Z)^2, \quad (3)$$

where $E_{\text{H exp}}$ - experimental value of energy of hydrogen-like atom for given Z and given n .

2. Correlation energy

The residual between precision energy of atom and energy calculated by one from methods of approximation of independent particles is named as correlation energy.

We can estimate accuracy of approach VM_1 with the help of correlation energy. In the present work we have analyzed of correlation energy of a method VM_1 for nl_1nl_2 states of helium-like atoms, where n - main quantum number, common for both electrons, and l_1 and l_2 - orbital quantum numbers of appropriate electrons. The similar analysis for a ground state of two-electron atoms can be found in various sources (for example in [2]), but we could not find any publication of similar investigation for doubly excited states (DES) and we claim for superiority in this problem. We have analyzed of correlation energy for all nl_1nl_2 states of He-like atoms, for which it

In the present work we use the one-configuration first approximation of a variational method (further VM_1), in which one parameter - charge of the nucleus varies only, and all interaction of electrons is with each other reduced only to mutual shielding by them of this charge. Thus VM_1 is most simple from all possible methods, which use approximation of independent particles. The description VM_1 can be found in many sources (for example - in [2]) and there is no necessity to consider it here in full details.

We note, that we not take into account in this approach exchange effects. The wave function of two-electron atom in this approximation is look as

Eventually formula of energy (hereinafter everywhere in the text as units of energy is used Rydberg -Ry) two-electron atom calculated by the method VM_1 is noted as

was possible to find the experimental data now, but because of limitation of the size of the article we shall present here as an example only data obtained for $nsns(1S)$ states. The values E_{He1} , calculated by a method VM_1 , values of energy $E_{\text{He exp}}$, taken from experiment, and also value of correlation energy $E_{\text{cor}} = E_{\text{He exp}} - E_{\text{He1}}$, for $nsns(1S)$ states are given in a table 1.

We have analyzed relation of correlation energy from Z and n , and have detected, that the nl_1nl_2 states are divided into two groups. The first group involves lowest states for the given configuration, i.e. states with least possible n . It is states, in which at least one electron is on the such orbit, for which $n = l + 1$. In the old quantum theory this condition corresponds to the special case of circular orbits. Second group involves all remaining states of configurations, i.e. states with $n > l + 1$ for everyone from two electrons. We obtained the formulas

$$E_{\text{cor}} = (1/2) \cdot C \cdot (1/n) \cdot Z \cdot [k_1 - k_2 \cdot (Z-1)/Z] \quad (4)$$

and

$$E_{\text{cor}} = (1/2) \cdot C \cdot (1/n) \cdot Z \cdot k_1 \quad (5)$$

accordingly for the first and second group of states, where k_1 and k_2 - integer factors, which values are given in a table 2, and C - numerical factor. The values C , at which formula (4) and (5) give precision co-

incidence with experiment, are given in a table 1 for nsns (1S) states. It is easy to see, that C with a large degree of probability is a constant and is in range 0,110-0,116, i.e. is close to 1/9.

Table 1. The data of experiment and calculations for nsns (1S) states of helium-like atoms for n from 1 up to 3

State	Z	$E_{He\ exp}$ (Ry)	E_{He1} (Ry)	E_{cor} (Ry)	C	E_{He} (Ry)	Ref. $E_{He\ exp}$
1s1s (1S)	1	1,0550	0,9448	0,1101	0,110	1,0559	[3]
	2	5,8068	5,6948	0,1120	0,112	5,8059	[4]
	3	14,5597	14,4457	0,1140	0,114	14,5568	[4]
	4	27,3131	27,1987	0,1143	0,114	27,3099	[4]
	5	44,0699	43,9561	0,1137	0,114	44,0672	[4]
	6	64,8318	64,7202	0,1116	0,112	64,8313	[4]
	7	89,6035	89,4946	0,1089	0,109	89,6057	[4]
	8	118,3845	118,2829	0,1016	0,102	118,3940	[4]
	9	151,1885	151,0900	0,0985	0,099	151,2011	[4]
	10	188,0111	187,9201	0,0910	0,091	188,0312	[4]
2s2s (1S)	1	0,2972	0,2444	0,0528	0,106	0,2999	[5]
	2	1,5571	1,4436	0,1135	0,114	1,5547	[6]
	3	3,8077	3,6431	0,1646	0,110	3,8098	[7]
	4	7,0788	6,8434	0,2354	0,118	7,0656	[7]
	5	11,3354	11,0452	0,2902	0,116	11,3229	[8]
3s3s (1S)	2	0,7206	0,6431	0,0776	0,116	0,7171	[9]
	6	7,4304	7,2260	0,2044	0,102	7,4482	[10]
	7	10,2379	9,9849	0,2530	0,108	10,2442	[11]
	8	13,4581	13,1900	0,2681	0,101	13,4863	[10]

Table 2. Factors k_1 and k_2

State	k_1	k_2
nsns(1S)	2	2
npnp(1D)	2	2
nsnp(3P)	2	0
npnp(3P)	1	0
nsnp(1P)	1	3
npnp(1S)	0	4

Finally we have following semi-empirical formula for calculation of full energy of helium-like atom for nl_1nl_2 states

$$E_{He} = E_{He1} + E_{cor}, \tag{6}$$

where E_{He1} is calculated by a method VM_1 and follows from the formula (2), and E_{cor} follows from the formulas (4) and (5) and is entered because of analysis of the experimental data.

In that specific case of states nsns (1S), npnp (1D), ndnd (1G) etc., when both electrons are on same orbit, or, as speak, occupy the same quantum cell, the formulas (4) and (5) receive especially simple kind

$$E_{cor} = C \cdot (1/n) \tag{7}$$

for $n = l + 1$ and

$$E_{cor} = C \cdot (1/n) \cdot Z \tag{8}$$

for $n > l + 1$.

We note, that our refusal to take into account of exchange degeneration is justified for these states from any point of view.

The particular case of the formula (7) for $n = 1$ corresponds to a ground state of helium-like atoms ($1s1s$) and results to $E_{\text{cor}} = C$, i.e. the correlation energy in this case does not depend from Z and it was marked by Bethe as the curious fact in [2]. The Hartree-Fock method also results in independence of correlation energy of a nuclear charge in case of a ground state $1s1s$, but the constant obtained at it, has average value 0,085 unlike 0,111 for case of a method VM_1 . The correlation energy of a Hartree-Fock method was a theme of many works at the end of 1950s and at the beginning of 1960s, however after appearance of the first experimental data on DES of atoms in a middle of 1960s the point of view has prevailed, that the Hartree-Fock method and generally approximation of independent particles is inapplicable for the description of a similar class of states because of large increase for them of correlation energy. The obtained above formulas show, that at least in case of a method VM_1 the approximation of independent particles can be applied successful for DES if to consider correlation energy not as an annoying error, but as the simply taken

into account correction with interesting physical properties which will be discussed below. Moreover, simplicity of obtained expressions results that the correlation energy is transformed from a problem into a proof of effectiveness of approximation of independent particles. Already now it is possible to use algorithm of calculation, offered us, as the simple and at the same time rather precision semi-empirical approximation to describe known lines of spectra of helium-like atoms and to predict or to help to identify until now unknowns lines.

The data of calculation of energy E_{He} under the formula (6), in the supposition, that $C = 1/9$, are given in table 1 for those of $nsns$ ($1S$) states, for which the experimental data are known. Goodness of fit of calculations with experiment quite satisfactory, taking into account errors of measurements and approximations at calculations. The data of the same calculation for a unknown for today $nsns$ ($1S$) states at n from 4 up to 10 and Z from 1 up to 10 are given as an example in a table 3.

Table 3. The data of calculation for $nsns$ ($1S$) states of helium-like atoms for n from 4 up to 10

Z	$E_{\text{He}}(\text{Ry})$ 4s4s	$E_{\text{He}}(\text{Ry})$ 5s5s	$E_{\text{He}}(\text{Ry})$ 6s6s	$E_{\text{He}}(\text{Ry})$ 7s7s	$E_{\text{He}}(\text{Ry})$ 8s8s	$E_{\text{He}}(\text{Ry})$ 9s9s	$E_{\text{He}}(\text{Ry})$ 10s10s
1	0,0893	0,0616	0,0459	0,0360	0,0293	0,0245	0,0210
2	0,4175	0,2762	0,1980	0,1500	0,1183	0,0962	0,0802
3	0,9958	0,6508	0,4612	0,3457	0,2699	0,2174	0,1794
4	1,8242	1,1854	0,8356	0,6230	0,4839	0,3879	0,3186
5	2,9029	1,8802	1,3212	0,9820	0,7605	0,6078	0,4979
6	4,2319	2,7352	1,9180	1,4227	1,0997	0,8771	0,7170
7	5,8114	3,7504	2,6260	1,9452	1,5014	1,1959	0,9763
8	7,6417	4,9261	3,4455	2,5494	1,9657	1,5641	1,2758
9	9,7230	6,2623	4,3763	3,2355	2,4927	1,9818	1,6152
10	12,0556	7,7592	5,4183	4,0035	3,0823	2,4490	1,9943

3. Results

3.1. From a point of view of physics of the formula (4) and (5) result to exotic, i.e. in nonclassical relation of energy of interaction of charged particles to a distance between them.

If in the formulas, obtained by us, to present n as a radius of atom r (remembering, that in hydrogen-like atoms $r \sim n^2$), we shall receive for different parts of full energy of atom of relation

$$E \sim 1/r^k,$$

where for terms, calculated by the method VM_1 , $k = 1$, that completely corresponds to the classical law of the Coulomb, and for correlation energy, $k = 1/2$. Thus here there is an additional interaction decreasing on a distance slower, than Coulomb force.

The additional calculations, carried out by us, have shown, that the relation $E \sim 1/r^{1/2}$, or accordingly $E \sim 1/n$, occurs only in that case, when both electrons have identical general quantum numbers n . We found proofs of existence of similar relation of correlation energy from a general quantum number of external electrons not only in helium-like atoms, but also in atoms with large number of electrons, and in molecules and crystals.

That fact, that coincidence of general quantum numbers n at both electrons is required for appearance of relation $E \sim 1/n$, can indicate resonant character of additional interaction. Moreover it results in electron-electron attraction, instead of repulsion and very strongly depends on a configuration of spin and orbital moment, that makes it even less similar to electrostatic

interaction, but similar to interaction, which exist between protons in the nucleus.

3.2. From a mathematical point of view it is obvious, that if in two-electron atom there were no nonclassical interactions, the method VM_1 would give precisely analytical solution of a three-body problem. The simplicity of the formulas (4-8) allows to hope, that the analytical solution is possible and with taking into account of nonclassical interactions. It would become possible after an evaluation of correlation energy E_{cor} and constant C from certain general principles.

3.3. From a practical point of view it is interesting, that since some value n usual Coulomb repulsion electrons (decreasing as $1/n^2$) will become less additional not - Coulomb attractions (decreasing as $1/n$). It can result in macroscopic case to join of electrons in certain stable or metastable structures - quasi-neutral (if number of electrons equally to number of positive ions) or charged, just as the protons are integrated in the charged nucleus. The similar processes could spontaneously happen in strong rarefied plasma of intersidereal space, in high layers of an ionosphere of the Sun, Earth and other cases, in which the large distances between charged particles (appropriate to the large values n) are realized. It is possible, that the similar effects could explain at least some from anomalous plasma-like effects observed in atmosphere and an ionosphere, such as a ball lightning etc.

To receive a similar new states of substance in experiment, it is necessary, that the electrons of substance were excited synchronously, i.e. had identical energy and identical values n in each instant. To the present moment not much of similar (doubly excited) states is obtained even for two-electron atoms. For molecules them it is known even less. Moreover both in case of atoms, and in case of molecules the values n are not reached yet value, at which the attraction between electrons exceeds a repulsion between them. In case of macroscopic skew fields the problem of synchronous excitation of electrons up to maximum large n till now not to pose, though technically it is not unattainable, since the similar problems are decided at creation of quantum generators of coherent electromagnetic radiation.

Let's remind also, that the explanation of a superconductivity involves appearance of additional electron-electron attraction, which exceeds Coulomb repulsion under certain conditions.

Moreover there are the direct analogies between additional correlation energy of electrons in superconductors and additional correlation energy of electrons in separate atoms in the literature (see for example [3]), and the Cooper pair sometimes is represented as two electrons moving round an induced positive charge, and is compared to atom of a helium.

All of this makes probable bose-einstein condensation of synchronously excited electrons both in atoms, and in macroscopic skew fields from that mo-

ment, when not - Coulomb attraction of electrons will begin to exceed Coulomb repulsion. The similar superconductivity already could be named super-high-temperature.

Conclusion

The approach based on separation of full energy of multielectron systems on classical Coulomb and nonclassical not - Coulomb parts, allows on the one hand to simplify calculations, and with another - to see interesting regularities, which were not visible at use of more complex methods. Most interesting is the discovery of that fact, that under certain conditions electron-electron attraction exceeds electron-electron repulsion. The most important practical consequence it is the capability of existence of ordered structures of a new type in the special way excited substance.

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POLYMER-IMPREGNATED CONCRETE BASED ON WATER DISPERSION OF VINYL CHLORIDE

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For the purpose of defining maximal chemical durability of the formed material at the optimal con-

tent of the polymer the kinetics of polymer concrete decomposition in acid media has been investigated.

The data got at the investigation of the air content dependence on the polymer-cement ratio in the mortar modified by ВДВХМК-65Е-ВДК (Fig.1) testify that in the area conforming to 7-10% content of the polymer from the cement mass the decrease of air entrainments and increase of the forming closed pores number, the result of which is receiving the polymer-cement frame possessing maximal chemical durability.

The possibility of cement systems lifetime increase in aggressive media owing to their modification by chemically resistant water dispersion has been established in principle.

For the purpose of establishing modified concretes' corrosion resistance the tests in various aggressive media: nitric, sulfuric and hydrochloric acids and also solutions of sodium chloride and sulfate, were carried out. The corrosion resistance was estimated on the modified materials' strength properties loss, when cured in 10% aggressive medium.

Due to the carried out experiments it is established that on the intensity degree of the effect on the modified mortars' physical and mechanical properties the investigated aggressive media represent the following comparative range: hydrochloric acid > sulfuric acid > nitric acid > sodium sulfate > sodium chloride > benzene. In salt solutions the modified materials' durability increases considerably compared to the non-modified ones.

The mathematical treatment of the experimental data inclusive of the works performed by the research workers of A.F. Polak's school, Ivanov F.M., Rozental N.K. and others allowed the author to suggest a calculation formula for the modified concretes' and mortars' durability definition depending on the aggressive agents in the exploitation medium:

$$\tau = -\frac{1}{A_0 \eta} \left[\frac{L}{L_0} \right]^2, \quad (1)$$

where η - is the aggressive substance concentration in the exploitation medium; L - the thickness of the construction being subjected to the exploitation medium's aggressive effect, (cm); L_0 - the laboratory sample thickness (4 cm); A_0 - the constant defined experimentally by the errors sum-of-squares minimization on the formula ($A_0 < 0$):

$$A_0 = \frac{\sum_{i=1}^M \eta_i t_i \ln\left(\frac{S_i}{S_0}\right)}{\sum_{i=1}^M \eta_i^2 t_i^2}, \quad (2)$$

where S_i - is the sample strength [kg/cm^2] after being cured in the aggressive medium for the time t_i ; m - the number of measurements carried out for every sample;

S_0 - the sample strength initial value [kg/cm^2]; η - the mortar concentration ($0 < \eta < 1$).

The established functional dependence and corrosion resistance of the modified mortars and concretes in acidic and salt aggressive media allow forecasting a material's lifetime and, consequently, structural units' durability as a whole at the anticorrosion protection design stage already.

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TECHNICAL SILICON REFINING

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Silicon is widely used in various branches of industry. So, due to its ability to create valuable alloys with unique properties Si is used for making rust-resistant pipes when obtaining silicon steel for electrical industry, in transformer, instrumental, corrosion-resistant, heat-proof, spring, constructive and other steels. Silumins (silicon and aluminum alloys) applied in space and aviation, automobile, instrument-building and other industries; corrosion-resistant silicon bronzes, silicon and magnesium alloys, abrasive materials based on silicon carbide are widely known. Silicon is used for the production of a wide range of organic silicon compounds. The ultrapure Si - is the main semi-conducting material for transistors, current rectifiers, radio waves enhancers, controllers, electronic chips for computing devices. Silicon serves as the basic material for making photoelectric converters (PEC) as well [1].

The technical (metallurgical) silicon (Si_{tech}) is obtained by the carbo-thermal method out of silica-containing raw material in electric arc furnaces on the general reaction: $SiO_2 + 2C = Si + 2CO$ [2,3]. The Si_{tech} obtained at the melting process dissatisfy the consumer requirements on the ultimate product chemical purity. That is why refining is practiced nowadays.

A complex operation of refining should reduce the content of Al , Ca , Fe , Ti and other admixtures in the silica and also fully remove small and big slag pockets. The silicon refining methods (those not introduced into production as well) at the national and overseas plants are based on the following physical and physico-chemical phenomena:

- the slag separation by settling the liquid for coagulation and separation of small inclusions into a single phase;
- the slag separation by the silicon remelting and settling an additive agent of the degassing flux;
- the separation of metallic impurities by their transferring into fugitive chlorides and fluorides by blowing with gases or solid additions gases;

- the same with an additive oxidative agent - O_2 and transfer of the admixtures (Ca , Al and others, for example) into oxides passing into slag;

- the purification of powdery silicon in solid by halogens, chlorhydric or sulphuric acids, etc.; the ultimate product being the refined silicon powder;

- the silicon treatment in plasma.

The main method of Si_{tech} commercial refining at the CJSC "Kremny" (Shelekhov, Irkutsk Region) – is the oxidizing-flux one performed in scoops by air blowing (with adding siliceous sand as the flux) [4]. We carried out the pilot plant tests on the operating equipment of the enterprise by two refining methods.

1. The refining of Si_{tech} by the oxidating method with the following crystallization was performed at the following parameters: the compressed air flow = 29-34 m^3/h ; the melt temperature = 1550-1570 $^{\circ}C$; the gas- and air mixture supply increase up to $\approx 0,6$ MPa; the blowing time = 16 hours; the silicon crystallization period = 48 hours.

2. The refining of Si_{tech} by the oxidating method by blowing the melt with oxygen-rich air was performed (without adding fluxes) at the following process variables: the pressure in the oxygen and compressed air supply lines $\approx 0,5$ MPa; the melt temperature = 1472-1481 $^{\circ}C$; the refining time (average) = 1,5 hours; the consumption indices of oxygen, compressed air, m^3/h , accordingly: 4; 19,5. After the carried out tests the degree of Si_{tech} refining from principal impurities made, %, accordingly: on the first method - Fe - 97,27; Al - 95,5; Ca - 99,64; on the second method – Fe - 6,7-8,2; Al - 70; Ca - 94,95.

Thus, the silicon refining procedures suggested allow obtaining refined silicon of high chemical purity without significant changes of the process flow sheet existing at the plant.

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ADVANCED FEATURES OF OIL-BEARING STRATA VERTICAL AND LATERAL HETEROGENEITY MAPPING AND STUDYING USING INFORMATION MEASURES

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As a rock characteristics heterogeneity measure in a vertical geological cross section the coefficient of relative entropy (Pelto, 1954; Yaglom, Yaglom, 1960; Dementyev, Khitrov, 1966; Ozhgibesov, 1975) was used.

$$K_{\phi} = \frac{- \sum_{i=1}^n p_i \log p_i}{\log N} \quad (1),$$

where K_{ϕ} – is the coefficient of relative probability entropy (coefficient of facial heterogeneity); n – the number of group intervals of the measured parameter; p_i – the probability of the observation result fall within the i -th group interval; N – the number of group intervals of the measured parameter (here $N=10$, that is why the denominator represented as a common logarithm is equal to 1).

The first extremal case. The petrophysical rock properties parameters' amplitudes have been studied on the bore well logs.

It goes from the formula (1) that at $n = 10$ and $p_i = 0,1$ the K_{ϕ} value is equal to 1. In the calculations we used the logarithm to base 10. The considered case conforms to the *maximal heterogeneity* of the vertical section of the isochronal stratigraphic range chosen. The number of facial rock types is equal to 10.

The second extremal case. If the vertical section is homogeneous, all the values of amplitudes in the well log fall within the same grouping class. In this case $p_i = 1$, and the K_{ϕ} value is equal to zero, as $\log 1 = 0$. The number of facial rock types in the vertical section is equal to 1.

Present-day computer technologies allow getting in the shortest time such vertical section heterogeneity complementary information, which is impossible to get in other ways. This heterogeneity can also be mapped.

For the geological section heterogeneity problem solution on the GC, OGC, SP and RC diagrams we applied the computer programs, which allow analyzing and interpreting the well information quickly using standard petrophysical algorithms and also making the relative section entropy map.

The use of the relative entropy coefficient for the evaluation of vertical section lateral variability has an advantage of other ways of mapping of facies re-

flecting the geological system heterogeneity. This advantage consists in the fact that the number of facial rock types, which are taken into consideration, when lateral variability of the facies evaluated by information measures theoretically unlimitedly (as distinct from the traditional method of drawing facial maps on the basis of lithological triangles).

The K_{Φ} value allows coming to the conclusion about facial heterogeneity of the vertical geological section in every well, and also studying the heterogeneity index variability in the studied area on the parameter value, which changes from 0 to 1. When using this extremely formalized information parameter, the lithology on the direct core sample observations should be taken into account, as $K_{\Phi} = 1$ for any homogeneous stratum. For example, for homogeneous porous sandstone and homogeneous dense argillite the K_{Φ} value will be the same. Rocks are indistinguishable on this formalized characteristic.

With the appearance of special computer programs allowing representing a well log automatically in the form of a discrete series of points and composing a histogram on the basis of these data in the preset number of grouping classes the possibilities of studying vertical and lateral heterogeneity of a geological section by information measures have increased.

The source material presentation and its further computer treatment procedure described here allow solving the problems, which couldn't be solved earlier because of the labour intensity and duration of measuring and computation operations (Ozhgibesov, 1975).

However, it should be borne in mind that the beginning of the problem solution and the problem definition itself consist in the substantiation and choice of a concrete stratigraphic interval with isochronal (or relative isochronal) boundaries of its bottom and roof. The analysis and final conclusions about the multivariable lithologic-petrophysical heterogeneity of the vertical section and its lateral variability should be made only with due account for (probably, simplified) the three-dimensional lithologic-petrophysical model of the studied territory.

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BASIC RESULTS OF WORKING OUT AND INTRODUCTION OF TECHNOLOGIES OF DESTRUCTION OF FRAGILE MATERIALS WITH APPLICATION OF PLASTIC SUBSTANCES IN MINING AND BUILDING

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Plastic substances for the purpose of destruction of natural or artificial brittle materials came into use comparatively not long ago. Despite of this fact there are concrete results briefly expressed in the following in this area.

The working out and realization of the brittle materials destruction technologies using plastic substances in industry should be connected with the initial definition and subsequent regard for a complex of factors reflecting the specificity of objective and subjective operative conditions.

The projecting of technologies of crushing firm formation lumps with drop-weight using plastic substances in conditions of mineral deposits exploitation open-cut mining method will be connected with: the necessity to use mining engineering able to produce high impact energies; the provision of destruction directivity elements absence by means of using smooth wading rods, the lack of the necessity to use estuarine parts and shot hole walls sealing; the use of maximally possible hole depth filled up with a plastic substance. Thereat, because of weight dropping height limitations there will be restrictions on maximum dimensions of the lump, the destruction of which takes place along the whole length of the hole drilled in it and filled up with a plastic substance practically simultaneously.

The projecting of technologies of crushing average and low strength formation lumps with a hydraulically and pneumatically operated hammer using plastic substances in conditions of mineral deposits exploitation open-cut mining method will be connected with: the possibility to use mining engineering producing lesser impact energies; the provision of destruction directivity elements absence by means of using smooth wading rods; the lack of the necessity to use estuarine parts and shot hole walls sealing; the use of maximally possible hole depth filled up with a plastic substance. Thereat, because of the tractor chasses-mounted hydraulically and pneumatically operated hammer raising possibilities limitations there will be restrictions on maximum dimensions of the lump, the destruction of which will take place in the contact point of the hydraulically and pneumatically operated hammer rod (lance) and plastic substance in the shot hole at its gradual moving from the estuarine part to the face one.

The projecting of technologies of crystalline rocks mining using plastic substances in conditions of