Influence of the changes in the equilibrium degree of inversion with temperature on the thermal capacity of a spinel. (Cont.)

$ZnFe_2O_4$, since it is known that for $\lambda > 0$ this ferrite becomes ferromagnetic and in this case the characteristic of the heat capacity is affected basically by the change in the magnetic energy. King (6) gives data on the heat capacity of $CaFe_2O_4$ and $CaFe_2O_5$ for which heat capacity anomalies were observed in the temperature range 150-390 K but no data are available on the structures of these crystals.

Acknowledgments are made to A. N. Orlov for his comments and useful advice.

(Note: This is a full translation except that eq.(2), p.545, has not been copied; in this equation β and α are elasticity coefficients).

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There are 6 references, 3 of which are Slavic.

SUBMITTED: February 28, 1957.

ASSOCIATION: Sverdlovsk Agricultural Institute.
(Sverdlovskiy Sel'skokhozyaystvennyy Institut).

AVAILABLE: Library of Congress

MEN', A.N.; ORLOV, A.N.

Binding energy theory of transition metal oxides. Issl. po zharopr. splav. 3:364-371 '58. (MIRA 11:11)
(Crystal lattices) (Metallic oxides)

AUTHOR: Men', A. N. SOV/126-6-5-3/43

TITLE: Dependence of the Equilibrium Value of the Lattice Constant of a Mixed Spinel From Composition (Zavisimost' ravnovesnogo znacheniya postoyannoy reshetki smeshannoy shpineli ot sostava)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 5, pp 781-785 (USSR)

ABSTRACT: The author deals with a spinel-type lattice. Such a lattice is typical for many ferromagnetic semiconductors (ferrites). The spinel lattice may be represented as a face-centred lattice of oxygen atoms, with various metal atoms in the tetrahedral and octahedral positions between lattice sites. To calculate the binding energy of lattices of this type Orlov and Men' (Ref 2) used a simplified spinel model which represents sufficiently well its main properties. This model has the following characteristics. (1) The negative and positive charges due to the oxygen electrons and nuclei are regarded as smeared out throughout the lattice. This means that the total electrostatic potential of this lattice is equal to zero. (2) The excess electrons of oxygen ions

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Dependence of the Equilibrium Value of the Lattice Constant of a Mixed Spinel From Composition

and the valence electrons of metal atoms (3d, 4s and 4p electrons in the case of iron-like atoms) are regarded as distributed with a constant density ρ throughout the lattice. The interactions of these electrons with metal ions are allowed for, using the statistical method of Gombash (Ref 3). (3) The phase spaces of electrons with left-handed and right-handed spins are considered separately. Calculations were carried out on the assumption that in the expression for the lattice energy it is sufficient to include only the following two terms: (i) electrostatic interaction of ions and electron gas; (ii) repulsion energy due to penetration of the "external" electron gas into ion frameworks (this gas is considered to be smeared out uniformly throughout the crystal). The author calculated constants s_μ, each of which represents interaction of the electron gas with a particular ion framework. The values of s_μ (Table 3)

Dependence of the Equilibrium Value of the Lattice Constant of a Mixed Spinel From Composition

were then used to find, from the lattice energies, the structural lattice constants a_o for 11 mixed spinels (Table 4). The experimental a_o (Table 4, cols. 2 and 5) and calculated (cols. 3 and 6) values of the lattice constants a_o were found to agree to within 0.1-0.2 Å for a_o of the order of 8 Å. The experimental dependence of the lattice constant of a particular spinel, e.g. $Zn_cCd_{1-c}Fe_2O_4$, on the concentration c of one component (e.g. zinc) was found to be fully reproduced (Table 5) when the values of s_μ listed in Table 3 were used to calculate the lattice constant a_o. The paper is entirely theoretical. Acknowledgment is made to A. N. Orlov for his advice.
There are 5 table and 6 references, 4 of which are Soviet and 2 English.

SOV/126-6-5-3/43

Dependence of the Equilibrium Value of the Lattice Constant of a Mixed Spinel From Composition

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut
(Sverdlovsk Agricultural Institute)

SUBMITTED: February 18, 1957

Card 4/4

SOV/58-59-5-10516

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 5, p 98 (USSR)

AUTHORS: Orlov, A.N., Men', A.N.

TITLE: Statistical Theory of Bond Energies in Oxides of Cubic-Lattice Transition Metals

PERIODICAL: Tr. In-ta fiz. metallov. Ural'skiy fil. AS USSR, 1958, Nr 20, pp 43-52

ABSTRACT: This article is a survey of the authors' studies based on a generalization of the method of solving the Thomas-Fermi equation for a diatomic molecule (RZhFiz, 1955, Nr 8, 16122) to the case of a crystal with allowance for electrons with two senses of spin (the d-shell of the transition metals). The bibliography contains 21 titles.

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ORLOV, A.N.; MEN', A.N.

Statistical theory of bond energy in spinel-type crystals.
Fiz. tver. tela 1 no.2:195-202 F '59. (MIRA 12:5)
(Spinel group) (Crystal lattices)

MEN', A.N.; ORLOV, A.N.

Vibrational frequency spectrum of a simple model of an ordering alloy. Issl.po zharopr.splav. 4:96-101 '59.
(MIRA 13:5)
(Crystal lattices) (Spectrum, Atomic)

AUTHORS: Men', A.N. and Orlov, A.N.

SOV/126-7-3-3/44

TITLE: The Spectrum of Vibrational Frequencies on the Simplest Model of an Ordering Alloy. II.

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 3, pp 335-340 (USSR)

ABSTRACT: In Ref 1 the present authors have considered the vibrations of a chain consisting of atoms of two types having almost equal masses and located over the chain sites with an arbitary degree of long-range order η, an arbitrary relative concentration c, and interacting elastically in such a way that the elastic coupling coefficients between any two neighbouring atoms are the same. In the present paper the treatment is generalized to the case in which the elastic coupling coefficients are different but not very different. An approximate calculation of the frequency spectrum shows that such a chain may be replaced by a completely ordered chain made up of effective atoms whose properties depend on c and η according to Eqs (2) and (3). It is shown that the maximum (Debye) frequency, as a function of the ratio of masses and coupling coefficients, may

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The Spectrum of Vibrational Frequencies on the Simplest Model of an Ordering Alloy. II.

either increase or decrease as the degree of long-range order in the chain increases. The theory is in general agreement with the reduction in the Debye temperature which was observed by Iveronova et al. (Ref 4) in ordering Cu_3Au and Ni_3Fe alloys.

There are 1 figure and 4 Soviet references.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, Ac.Sc., USSR)

SUBMITTED: November 22, 1957

Card 2/2

AUTHOR: Men', A.N. SOV/126-7-3-27/44

TITLE: The Frequency Spectrum of a Chain of Atoms, Obtained by Taking into Account Interactions Between Neighbours of any Order (Spektr chastot tsepochki atomov pri uchete vzaimodeystviya sosedey lyubogo poryadka)

PERIODIC: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 3, pp 450-453 (USSR)

ABSTRACT: The present note discusses the vibrations of a linear chain made up of N-atoms of one type. It is assumed that the chain is closed and the equation of motion for the nth atom is given by Eq (1), where X_n is the displacement of the atom and $\alpha(j)$ is the coupling constant. Solutions of Eq (1) are sought in the form of Eq (2). Expressions are derived for the frequencies ω and are given by Eqs (8), (9) and (10). These equations are found to reduce to all the special cases considered previously (Refs 2-4). There are 4 references, 3 of which are Soviet and 1 English.

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut (Sverdlovsk Agricultural Institute)

SUBMITTED: June 12, 1957

Card 1/1

SOV/126-7-4-22/26

AUTHOR: Men', A.N.

TITLE: On the Determination of the Number of Long-Range Order Parameters for Multi-Component Alloys

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 4, pp 633-635 (USSR)

ABSTRACT: It is shown that if the number of types of atoms is m and the number of types of sub-lattice sites is m_1, then the number of arbitrary long-range parameters is given by $p = mm_1 - (m + m_1 - 1)$. There are 4 references, 2 of which are Soviet, 1 Japanese and 1 Polish.

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut (Sverdlovsk Agricultural Institute)

SUBMITTED: February 10, 1958

Card 1/1

24.6200

66905

AUTHORS: Men', A.N. and Orlov, A.N. SOV/126-8-1-23/25

TITLE: On the Theory of Vibrational Spectra of Solid Solutions

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 1, pp 154-156 (USSR)

ABSTRACT: The authors have calculated (Refs 1 and 2) the frequency spectrum of elastic vibrations on a one-dimensional model of an ordering binary solid solution, using the method of "effective atoms". Lifshits and Stepanova (Ref 3) have also introduced this idea in their work on the vibrational spectrum of the three-dimensional binary solid solution of isotopes. The method of "effective atoms" may be used when the mass difference between atoms of different kind $M_j - M_{j'}$, and the difference between the elastic coupling coefficients $A^{jj'}_{qq'} - A^{j''j'''}_{qq'}$ are small, as a result of which the change in the vibrational spectrum of an ideal monoatomic crystal of given symmetry, due to the fact that the atoms are not identical and their distribution over the sites is different from the ordered distribution, may be

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66905

SOV/126-8-1-23/25

On the Theory of Vibrational Spectra of Solid Solutions

considered as a small perturbation. In the present note it is pointed out that the method of "effective atoms" is applicable both to the one-dimensional and the three-dimensional case even if the coupling coefficients are different and the number of atoms per elementary cell is arbitrary.
There are 8 Soviet references, one of which is a translation from German.

ASSOCIATIONS: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc., USSR) and
Sverdlovskiy sel'skokhozyaystvennyy institut
(Sverdlovsk Agricultural Institute)

SUBMITTED: August 25, 1958

Card 2/2

18.1000, 5.4130

66220
SOV/126-8-3-3/33

AUTHORS: Men', A. N. and Orlov, A.N.

TITLE: On Binary Solid Solutions with Interatomic Bonding of Two Types

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 337-341 (USSR)

ABSTRACT: In the theory of binary alloys the energy of the crystal is often represented in the form of a sum of the energies of interactions between pairs of atoms. It is assumed that the interaction energy for a given pair is determined only by the type of the two atoms. However, in general this energy depends on the nature and the disposition of all the atoms surrounding the given pair XY. Moreover, even if one limits ones attention to the interaction of the pair XY with the nearest neighbours, then the energy of the pair V_{XY} can take on a number of values $V_{XY}^{(i)}$, where i denotes the number of the configuration surrounding the pair XY. One could try to take this into account by expressing the energy of the crystal not as a sum of all the possible XY and i but as the sum of energies of complexes formed by each atom with its

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On Binary Solid Solutions with Interatomic Bonding of Two Types

nearest neighbours. In that case the energy of each complex is taken as equal to the sum of energies $V_{XY}^{(\alpha)}$ corresponding to a given pair of atoms of given type XY in the complex of type α. If the energy levels of electrons in the atoms of a complex are close (almost degenerate), then the formation of resonating orbits becomes possible. This case is realised in pure metals. If the levels are very distant, then the resonance is less probable but, under certain conditions, localized covalent bonds may be formed. If the atoms of a complex do not have a sufficient number of electrons in order to ensure the saturation of all the localized covalent bonds, then some of them will become unsaturated. One might expect that this would lead to a relatively stable local distortion of valence angles and interatomic distances in a complex. The distance between atoms which take part in covalent bonding will be smaller and the interaction energy greater between neighbouring atoms of the same type but not coupled in this way. This leads to the appearance of interatomic bonding of two types which can conventionally be designated as weak and

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On Binary Solid Solutions with Interatomic Bonding of Two Types

strong. An expression is derived for the free energy of a binary solid solution with these two types of bonding. From the condition for a minimum in this energy the authors obtained at a given temperature the number of strongly and weakly bonded pairs of neighbouring atoms of different types. It is found that the number of pairs of different types does not depend monotonically on temperature. It is suggested that this effect may lead to an anomalous temperature behaviour of resistivity in certain alloys of transition metals.
There are 1 figure, 1 table and 6 references, 3 of which are Soviet, 1 German and 2 English.

ASSOCIATIONS: Institut fiziki metallov AN SSSR and Sverdlovskiy sel'skokhozyaystvennyy institut (Institute of Physics of Metals, Ac.Sc., USSR and Sverdlovsk Agricultural Institute)

SUBMITTED: September 4, 1958

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66235
SOV/126-8-3-19/33

18.1000

AUTHOR: Men', A.N.

TITLE: On the Determination of the Number of Arbitrary Short-range Order Parameters for Multicomponent Alloys

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 449-452 (USSR)

ABSTRACT: The problem considered is that of a n-component alloy containing λ sublattices. It is shown that the number of independent short-range order parameters is given by

$$N_\sigma = \frac{(n-1)(m_z n - 2m_1)}{2}$$

where n is the number of types of atoms, m_z is the number of elements in the matrix

$$Z = \left\{ Z_{\mu\nu} \right\}, \qquad (1)$$

$Z_{\mu\nu}$ is the number of nearest sites in sublattice ν to a given site in sublattice μ and $\mu,\nu = 1,2 \ldots \lambda$, m_1 is the number of elements in the matrix Z for

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66235

SOV/126-8-3-19/33

On the Determination of the Number of Arbitrary Short-range Order Parameters for Multicomponent Alloys

which $\nu > \mu$. A. N. Orlov is thanked for his valuable suggestions.
There are 2 figures and 3 references, 1 of which is Soviet, 1 Polish and 1 English.

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut (Sverdlovsk Agricultural Institute)

SUBMITTED: January 2, 1959

Card 2/2

AUTHOR: Men', A.N.

S/139/60/000/005/019/031
E032/E114

TITLE: Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No. 5, pp 112-117

TEXT: In using the Thomas—Fermi method to calculate the charge density in systems containing ions of transition metals, it is necessary to take into account the experimentally established fact that the inner electron shells of these ions have non-zero resultant spins. Moreover, in accordance with the so-called maximum multiplicity rule (Hund's rule) the spins in the d-shell are oriented so that the resultant spin has the maximum possible value. The statistical theory which does not take into account the spin-orbit interaction is unable to explain this fact. It can, however, be taken into account by assuming that electrons with left and right spin directions are located in different effective fields with potentials $\bar{V}_1$ and $\bar{V}_2$ where $\bar{V}_1 - \bar{V}_2$ is chosen so as to

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E032/E114

Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

obtain the required relative number of left and right oriented spins. The present author gives a derivation of the Thomas—Fermi and Thomas—Fermi—Dirac equations for these cases. The system is assumed to be described by the Hamiltonian

$$\hat{H} = \frac{e^2}{2} \sum_{g,h}{}' \frac{z_g z_h}{r_{gh}} + \sum_{i=1}^{n} \frac{P_i^2}{2m} - e \sum V_{gi} + \frac{e^2}{2} \sum_{ij}{}' \frac{1}{r_{ij}} \qquad (1.3)$$

where z_g is the atomic number of the nucleus g, V_g is the potential due to the nuclei, and $\bar{V}$ is the additional potential. The sum of these potentials is denoted by V_{gi} so that

$$V_{gi} = V_g + \bar{V}. \qquad (1.3a)$$

The ground state energy of the system is then calculated from

$$E = \int \Delta^* \hat{H} \Delta \, dq \qquad (1.4)$$

where

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Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

$$\Delta(1,2....n) = (n!)^{-\frac{1}{2}} \, det \, \{u_1....u_n\} \qquad (1.1)$$

and u_j are the spin orbit functions which are linearly independent but are not necessarily orthogonal. The ground state energy is then given by

$$E = \frac{e^2}{2} \sum_{g,h}{}' \frac{z_g z_h}{r_{gh}} - e \int V_{g_1} \rho(1,1) d\, q_1 - \frac{1}{2} e \int V_e \rho(1,1)\, d\, q_1 +$$

$$+ \frac{1}{2m} \int p_1^2 \rho(1,1) d\, q_1 - \frac{e^2}{2} \int \frac{\rho(1,2)\rho(2,1)}{r_{12}} d\, q_1\, d\, q_2, \qquad (1.7)$$

where

$$V_e = -e \int \frac{\rho(2,2)}{r_{12}} dq_2 \qquad (1.8)$$

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Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

The kinetic energy E_k and the exchange energy E_A are assumed to be of the form

$$E_k = \chi'_k \int \rho^{5/3} \, d\,q, \tag{1.9}$$

where

$$\chi_k = \frac{3}{5} \frac{h^2}{2m} \left(\frac{3}{4\pi}\right)^{2/3}, \tag{1.10}$$

$$E_A = - \chi'_a \int \rho^{4/3} \, d\,q, \tag{1.11}$$

where

$$\chi'_a = \frac{3}{2} e^2 \left(\frac{3}{4\pi}\right)^{1/3} \tag{1.12}$$

and when these are substituted into Eq. (1.7) the final expression for the ground state energy as a function of the charge density ρ is given by

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E032/E114

Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

$$E = \frac{e^2}{2} \sum_{g,h}{}' \frac{z_g z_h}{r_{gh}} - e \int V_{g1}\, \rho\, dq - \frac{1}{2} e \int V_e \rho\, dq + \\ + \chi'_k \int \rho^{5/3}\, dq - \chi'_a \int \rho^{4/3}\, dq. \qquad (1.13)$$

The expression for the total energy of a crystal consisting of a mixture of two electron gases with densities ρ_1 and ρ_2 corresponding to the two spin orientations is then

$$E = \frac{e^2}{2} \sum_{g,h}{}' \frac{z_g z_h}{r_{gh}} - e \int V_g\, (\rho_1 + \rho_2)\, dq - \frac{1}{2} e \int V_e (\rho_1 + \rho_2)\, dq + \\ + \chi'_k \int (\rho_1^{5/3} + \rho_2^{5/3})\, dq - \chi'_a \int (\rho_1^{4/3} + \rho_2^{4/3})\, dq \qquad (1.14)$$

It follows from these equations that the Poisson equation connecting the potential with the charge density is of the form

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Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

$$\Delta V = 4\pi e (\rho_1 + \rho_2), \qquad (1.23)$$

$$\rho_1 = \sigma'_0 \left[(V - V_1 + \tau'^2_0)^{\frac{1}{2}} + \tau'_0\right]^3$$

$(\ell = 1,2)$

where

$$\rho_1 = \sigma'_0 \left[(V - V_1 + \tau'^2_0)^{\frac{1}{2}} + \tau'_0\right]^3 \quad (i = 1,2), \qquad (1.21)$$

and

$$\sigma'_0 = \frac{3e}{5\chi'_k}^{\frac{1}{2}}, \quad \tau'_0 = \frac{4\chi_a'^2}{15\chi'_k e}^{\frac{1}{2}}. \qquad (1.22)$$

Thus the final Poisson equation describing the system and including the effects of partly filled shells is of the form

$$\Delta V = 2\pi e\sigma_0 \left\{\left[(V - V_1 + \tau_0^2)^{\frac{1}{2}} + \tau_0\right]^3 + \left[(V - V_2 + \tau_0^2)^{\frac{1}{2}} + \tau_0\right]^3\right\}$$

(1.27)

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E032/E114

Derivation of the Thomas—Fermi and the Thomas—Fermi—Dirac Equations Taking into Account Partly Filled Electron Shells

The usual Thomas—Fermi—Dirac equation can be obtained from this by putting $V_1 = V_2 = V_0$ and the Thomas—Fermi equation by putting $\tau_0 = 0$. The solution of Eq.(1.7) is subject to the boundary conditions

$$\lim_{\bar{r} \to \bar{r}_i} (\bar{r} - \bar{r}_i)V = z_i e, \qquad \lim_{r_i \to \infty} V = 0. \tag{1.31}$$

This is an abridged translation. Acknowledgements are made to A.N. Orlov for discussions and valuable advice.
There are 8 references: 6 Soviet, 1 German and 1 English.

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut (Sverdlovsk Agricultural Institute)

SUBMITTED: November 16 1959, and after revision May 9 1960

Card 7/7

S/126/60/009/06/001/025
E032/E314

AUTHOR: Men', A.N.

TITLE: Determination of the Number of Independent Long- and Short-range Order Parameters in Multicomponent Solid Solutions

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 801 - 809 (USSR)

ABSTRACT: The present work is concerned with the discussion of the concept of long- and short-range order parameters in multicomponent crystals having a complex structure, the determination of the number of independent parameters and the generalization of previous results obtained by the present author in Refs 2 and 6. Surface, linear and point defects are not considered, although the mathematical apparatus developed can be used to allow for them. The discussion is quite general. In the determination of the long-range order, the distribution of atoms over both equivalent and non-equivalent sites (these are defined in Refs 2 and 6) is taken into account, while in the case of the short-range order both the distance and the position of the atoms in the intermediate spheres are accounted for. A method is given for finding the number of independent

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S/126/60/009/06/001/025
E032/E314

Determination of the Number of Independent Long- and Short-range Order Parameters in Multicomponent Solid Solutions

short-range order parameters which takes into account second-order neighbours. The treatment is highly abstract, but the results obtained can (and should) be taken into account in the statistical theory of order in multicomponent solid solutions and, in particular, in the study of temperature and concentration dependences of short-range order parameters in the first and second coordination spheres.

Acknowledgment is made to A.N. Orlov for discussions and helpful advice. There are 10 references, 7 of which are Soviet, 1 Japanese (in English) and 1 English.

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut (Sverdlovsk Agricultural Institute)

SUBMITTED: April 22, 1959

Card 2/2

MEN', A.N.

Theory of the oxidation-reduction equilibrium in wüstite.
Fiz.met.i metalloved. 10 no.1:142-145 Jl '60. (MIRA 13:8)

1. Institut metallurgii Ural'skogo filiala AN SSSR.
(Wustite) (Oxidation-reduction reaction)

MEH', A.N.

Determining short-range order in a multicomponent disordered solid solution. Fiz.met.i metalloved. 10 no.1:145-148 Jl '60. (MIRA 13:8)

1. Institut metallurgii Ural'skogo filiala AN SSSR.
(Solutions, Solid) (Crystal lattices)

MEN', A.N.

Configurational free energy of multicomponent solid solution considering the distribution of atoms in sublattice interstices. Fiz. met. i metalloved. 10 no.4:630-631 O '60. (MIRA 13:11)

1. Institut metallurgii AN SSSR.
(Crystal lattices) (Solutions, Solid)

S/126/60/010/005/003/030
E032/E414

AUTHOR: Men', A.N.

TITLE: Calculation of the Correlation Parameters for the Second Coordination Sphere of an n-Component Solid Solution

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol.10, No.5, pp.655-660

TEXT: This is a mathematical paper and a continuation of the previous work by the present author in Ref.1 to 4. A calculation is given of the correlation parameters for the second coordination sphere of a multi-component solid solution. The disposition of the atoms on intermediate sites is taken into account. The theory applies to an unordered solid solution with equivalent sites containing N_i atoms of type i, where $i = 1, 2, 3, \ldots, n$. There are 6 references: 5 Soviet and 1 Non-Soviet.

ASSOCIATION: Institut metallurgii UFAN SSSR (Institute of Metallurgy, UFAN USSR)

SUBMITTED: April 11, 1960

Card 1/1

21510
S/139/61/000/002/005/018
E032/E414

24.6100

AUTHOR: Men', A.N.

TITLE: Approximate Solutions of the Thomas-Fermi Equation for an Atom

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1961, No.2, pp.42-45

TEXT: Analytical expressions giving approximate solutions of the Thomas-Fermi equation for an atom

$$y'' = y^{3/2}/x^{1/2} \qquad (1)$$

have been given by H.C.Brinkman (Ref.5), T.Tietz (Ref.6) and K.Umeda and S.Kobayashi (Ref.7). The approximate solutions of Eq.(1) are based on the fact that

$$\chi = \sqrt{yx} \qquad (2)$$

is a slowly varying function (assumed constant). The arbitrary constants are then chosen so that y should agree with tabulated values. The present author uses the method of

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approximate integration of differential equations put forward by S.A.Chaplygin (Ref.4) to obtain approximate solutions of Eq.(1). In this method two functions z and u are chosen so that

$$z''-z^{5/4}/x^{1/4}>0, \qquad u''-u^{5/4}/x^{1/4}<0. \tag{3}$$

The choice of the functions z and u can be made with the aid of the following two lemmas.

Lemma 1. If two functions f(x) and $\varphi(x)$ are differentiable in the region G and satisfy the conditions $f'(x)>\varphi'(x)$ and $f(x_0)=\varphi(x_0)$ then for any $x\in G$ the following inequality will always hold: $f(x)>\varphi(x^1)$.

Lemma 2. If two functions f(x) and $\varphi(x)$ can be differentiated n times and satisfy the conditions

1) $f(x_0)=\varphi(x_0), \quad f'(x_0)=\varphi'(x_0)\ldots \quad f^{(n-1)}(x_0)=\varphi^{(n-1)}(x_0);$

2) $f^{(n)}(x)>\varphi^{(n)}(x);$

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0.43

then for any $x \in G$ the following inequality will always hold: $f(x) > \varphi(x)$. Consider now the differential equation

where
$$y^{(n)} = f(x, y, y', y'' \ldots y^{(n-1)}),$$
$$y(x_o) = y_o, \quad y'(x_o) = y'_o, \ldots y^{(n-1)}(x_o) = y_o^{(n-1)}. \tag{5}$$

Let us now set up another differential equation of the form

$$z^{(n)} = \varphi(x, z, z', z'' \ldots z^{(n-1)}) \tag{6}$$

where $z(x_o) = y_o$, $z'(x_o) = y_o'$ ..., $z^{(n-1)}(x_o) = y_o^{(n-1)}$.
In Eq.(6) the function φ is chosen so that $\varphi > f$ in the region G. It then follows from Eq.(5) and (6) that $z^{(n)} > y^{(n)}$, i.e. using Lemma 2, we have $z > y$. Proceeding in a similar way for $\varphi < f$, and introducing the function u, we find that

$$z > y > u \tag{7}$$

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Consider now

$$y'' = f(x,y) \tag{8}$$

where

$$\frac{\partial f}{\partial y} > 0, \quad y(x_0) = y_0, \quad y'(x_0) = y'_0$$

Then, according to the above, one can find the function z satisfying Eq.(7) from the differential equation

$$z'' = \varphi(x,z) \tag{9}$$

Consider the equation

$$z_1'' = f(x,z) \tag{10}$$

One can show that $z > z_1 > y$. In fact from Eq.(9) and (10) we have

$$z'' - z_1'' = \varphi(x,z) - f(x,z) > 0 \tag{11}$$

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It follows from Lemma 2 that

$$z > z_1 \tag{12}$$

Subtracting Eq.(8) from Eq.(10) we find that

$$z_1'' - y'' = f(x,z) - f(x,y) > 0 \tag{13}$$

and since $\frac{\partial f}{\partial y} > 0$ and $z > y$, we have in accordance with Lemma 2, $z_1 > y$. Proceeding in a similar way with the function y we are led to Eq.(4). By continuing this process indefinitely, we can establish the limiting functions z_n and u_n which are as near to y as required. In order to find the functions φ and ψ for Eq.(1) let

$$\mu = \max \chi \tag{14}$$

from which it is clear that

Card 5/8

Approximate Solutions of ...

$$i_s = i_0\left\{(e^{aV_s}-1)\left(1-\alpha_0^2\frac{w_1}{w_0}\right)-\alpha_0(e^{-aV_s}-1)\left(1-\frac{w_1}{w_0}\right)\right\},$$

$$i_k = i_0\left\{\alpha_0(e^{aV_s}-1)-(e^{-aV_k}-1)\right\}\left(1-\frac{w_1}{w_0}\right). \qquad (15)$$

The solution of the equation

$$z'' = \frac{z}{x}\,\mu \qquad (16)$$

subject to the condition $z(o) = 1, \quad z'(o) = y'(o)$

gives

$$z = c\sqrt{x}\,K_1\,(2\sqrt{\mu}\,x^{1/2}), \qquad (17)$$

where K_1 is the modified Bessel function of the second kind and $C = 0.42$. The solution of the equation

$$u'' = \frac{u2}{\mu} \qquad (18)$$

subject to the condition $u(o) = 1, \quad u'(o) = -\sqrt{\frac{2}{3\mu}}$

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gives

$$u = \frac{6\mu}{(x + \sqrt{6\mu})^2}. \qquad (19)$$

The quantity μ can easily be found from the data reported by P.Gombash (Ref.2) and is found to be

$$\mu = 0.70 \qquad (20)$$

Expressions similar to Eq.(17) and (19) have been obtained by H.C.Brinkman (Ref.5) and P.Gombash (Ref.2) from the condition λ = const and are of the form

$$y = c\sqrt{x}K_1(2\sqrt{\mu}x^{1/4}), \quad \mu = 0,64, \; c = 1,73,$$
$$y = 6\mu/(x + \sqrt{6\mu})^2, \quad \mu = 0,58. \qquad (21)$$

There are 7 references: 4 Soviet and 3 non-Soviet.

21510

S/139/61/000/002/005/018
E032/E414

Approximate Solutions of ...

ASSOCIATION: Sverdlovskiy sel'skokhozyaystvennyy institut (Sverdlovsk Agricultural Institute)

SUBMITTED: November 16, 1959 (initially)
May 9, 1960 (after revision)

Card 8/8

MEN', A.N.

Distribution of cations in a multicomponent stoichiometric spinel.
Fiz.tver.tela 3 no.4:1054-1060 Ap '61. (MIRA 14:4)

1. Ural'skiy filial AN SSSR, Institut metallurgii, Sverdlovsk.
(Spinel group) (Cations)

MEN', A.N.

Effect of cation distribution in a multicomponent stoichiometric spinel on the equilibrium pressure of oxygen. Fiz.tver.tela 3 no.4:1101-1104 Ap '61. (MIRA 14:4)

1. Ural'skiy filial AN SSSR, Institut metallurgii, Sverdlovsk.
(Cations) (Spinel group)

MEN', A.N.

Determination of the configurational heat capacity of a multicomponent spinel. Fiz. tver. tela 3 no.8:2466-2469 Ag '61. (MIRA 14:8)

1. Ural'skiy filial AN SSSR, Institut metallurgii, Sverdlovsk.
(Spinel group--Thermal properties)

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30763
S/141/61/004/003/014/020
E192/E382

AUTHOR: Men', A. .

TITLE: An approximate method of analysis of non-stationary fluctuation spectra

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, v. 4, no. 3, 1961, pp. 521 - 533 + 1 plate

TEXT: Experimental investigation of the fluctuations encountered in the propagation of ultrahigh-frequency waves in the troposphere by a number of authors (Ref. 1 - A.P. Deam, B.M. Tannin - Proc. IRE, 43, 1402, 1955; Ref. 2 - the author and his team - DAN SSSR, 125, 1019, 1959; Ref. 3 - ditto - this journal, 2, 848, 1959; Ref. 4 M.C. Thompson, H.B.Yanes, J.Res. NBS, 63D, 45, 1959; Ref. 5 - the author - Radiotekhnika i elektronika) showed that their autocorrelation and spectral characteristics were non-stationary. Consequently, in order to determine the average spectral characteristics, it is necessary to employ the statistical method of analysis of a whole series of independent measurements which should be carried out under identical conditions. This method is based on the spectral analysis

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An approximate method ....

of a given process by an analyser having a high resolving power; this consists of a large number N of narrow-band filters and is a very complex equipment. However, in many cases, it is sufficient to employ a more simple analyser consisting of several (e.g. 2) wide-band filters which cover the whole fluctuation spectrum. In the simplest two-filter analyser it is possible to determine approximately the relative bandwidth of the spectrum by an integral coefficient γ, which is equal to the ratio of the fluctuation powers at the input of these filters. The experimental application of this method for determining the phase-difference fluctuation spectra is investigated in this work. The phase-difference spectra were measured at a wavelength of λ = 10 cm over a distance of L = 33 km . The spectra were found for various heights of the receiving and transmitting antennae h and h_o, respectively, and distances d between the antennae. The spectra could be determined from the coefficient γ, which is defined by:

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E192/E382

An approximate method ....

$$\gamma(d) = \sigma_B/\sigma_H = \overline{(\delta\varphi_1 - \delta\varphi_d)^2_B}/\overline{(\delta\varphi_1 - \delta\varphi_d)^2_H} \qquad (2)$$

where σ_B and σ_H are the average square values of the phase-difference fluctuations measured at the output of the high- and low-frequency filters, respectively; and

φ_1 and φ_d are phase fluctuations of the signals at the points spaced by a distance d.

In general, γ is a function of d, h, h_o, L and time t.

The parameter γ is also dependent on the limiting frequency F_c between the bandwidths of the filters and this should be chosen in such a way that γ should be near to unity. The coefficient γ as a function of d can be expressed by:

Card 3/8

An approximate method ....

$$\gamma(d) = \frac{\overline{\delta\varphi_B^2}(1 - r_B)}{\overline{\delta\varphi_H^2}(1 - r_H)} = \gamma_o \frac{1 - r_B}{1 - r_H} \qquad (4)$$

where r_B and r_H are the spatial correlation coefficients for the high- and low-frequency fluctuations, respectively. It is shown that these coefficients can approximately be expressed by:

$$r_H = \frac{\sqrt{\pi}\,\ell_H}{2d} \operatorname{erf} \frac{d}{\ell_H} ; \quad r_B = \frac{\sqrt{\pi}\,\ell_B}{2d} \operatorname{erf} \frac{d}{\ell_B} \qquad (8)$$

where $\operatorname{erf} x = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ is the probability integral and

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An approximate method ....

l_H and l_B are the characteristic scaling factors characterising the size of the nonhomogeneities which produce the fluctuations. In the case when the wave propagates over a sharp discontinuity the phase-difference fluctuations can be expressed by (Ref. 10 - the author and his team - DAN SSSR, 2, 740, 1959; Ref. 11 -ditto- this journal, 2, 388, 1959):

$$\overline{\delta\varphi_B^2}=0{,}25\pi^{5/2}(\overline{\delta\varepsilon})_B^2\frac{l_B L}{\lambda^2}\left[\frac{1-r_B(z)}{\mathrm{tg}^2(\varphi_1/2)}+1+r_B(z)\right]; \qquad (13)$$

$$\overline{\delta\varphi_H^2}=0{,}25\pi^{5/2}(\overline{\delta\varepsilon})_H^2\frac{l_H L}{\lambda^2}\left[\frac{1-r_H(z)}{\mathrm{tg}^2(\varphi_1/2)}+1+r_H(z)\right]. \qquad (13a)$$

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where $r_H(z)$ and $r_B(z)$ are correlation coefficients of the fluctuations in the direct and reflected waves for the discontinuity. These coefficients can be expressed by:

Card 5/8

An approximate method ....

$$r_{\text{н}}(z) = \frac{\sqrt{\pi}\, l_{\text{н}}}{2z} \operatorname{erf} \frac{z}{l_{\text{н}}}; \qquad r_{\text{в}}(z) = \frac{\sqrt{\pi}\, l_{\text{в}}}{2z} \operatorname{erf} \frac{z}{l_{\text{в}}}; \tag{14}$$

$$z \simeq \frac{2hh_0}{h + h_0}, \tag{14a}$$

where φ_1 is the spatial delay angle between the direct and reflected waves. The coefficient γ can be expressed by:

$$\gamma_{d=\text{const}}(h,\ L) = \varkappa \left[\left(1 - \frac{\sqrt{\pi}\, l_{\text{в}}}{2z} \operatorname{erf} \frac{z}{l_{\text{в}}}\right) \operatorname{ctg}^2 \left(\frac{2\pi h h_0}{L\lambda}\right) + 1 + \frac{\sqrt{\pi}\, l_{\text{в}}}{2z} \operatorname{erf} \frac{z}{l_{\text{в}}} \right] \times \tag{15}$$

$$\times \left[\left(1 - \frac{\sqrt{\pi}\, l_{\text{н}}}{2z} \operatorname{erf} \frac{z}{l_{\text{н}}}\right) \operatorname{ctg}^2 \left(\frac{2\pi h h_0}{L\lambda}\right) + 1 + \frac{\sqrt{\pi}\, l_{\text{н}}}{2z} \operatorname{erf} \frac{z}{l_{\text{н}}} \right]^{-1},$$

where $\varkappa$ is a constant given by:

$$\varkappa = \left(1 - \frac{\sqrt{\pi}\, l_{\text{в}}}{2d} \operatorname{erf} \frac{d}{l_{\text{в}}}\right) \left(1 - \frac{\sqrt{\pi}\, l_{\text{н}}}{2d} \operatorname{erf} \frac{d}{l_{\text{н}}}\right)^{-1} \frac{\overline{(\delta\varepsilon)^2_{\text{в}}}\, l_{\text{в}}}{\overline{(\delta\varepsilon)^2_{\text{н}}}\, l_{\text{н}}}. \tag{15a}$$

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S/141/61/004/005/014/020
E032/E382

An approximate method ....

Eq. (15) can be simplified for various special cases, such as $z \gg \ell_B$ or $z \gg \ell_H$. Some of the results obtained with this formula are illustrated in Fig. 56, where γ is plotted as a function of the distance L for various values of ℓ_H and ℓ_B. The calculated and the experimental data show that as the length of the transmission route is increased, it is possible to observe a relative broadening of the fluctuation spectrum which is due to the presence of a boundary surface and the nonhomogeneity of the medium. The time dependence of the spectral characteristics of the fluctuations was also studied experimentally; in particular, their dependence on the velocity and the direction of wind was measured. It was found that γ was almost independent of the direction and strength of the wind.

There are 8 figures and 13 references: 10 Soviet-bloc and 3 non-Soviet-bloc. The English-language not mentioned in the text is: Ref. 6 - R.B. Muchmore and A.D. Wheelon, Proc. IRE, 43, 1437, 1955.

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4

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S/141/61/004/003/014/020
E192/E382

An approximate method ....

ASSOCIATION: Institut radiofiziki i elektroniki AN UkrSSR (Institute of Radiophysics and Electronics of the AS UkrSSR)

SUBMITTED: December 1, 1960

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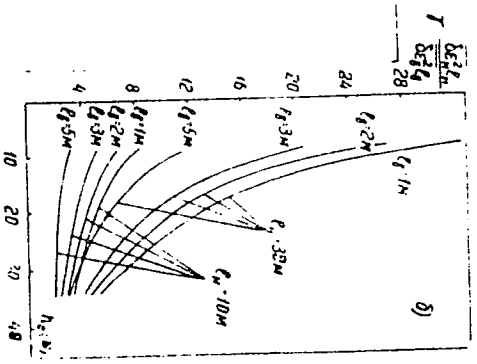
Fig. 56:



Card 8/8

MEN', A.N.

Frequency spectrum of a linear chain of a special form. Izv.vys. ucheb.zav.; fiz. no.5:101-108 '61. (MIRA 14:10)

1. Sverdlovskiy sel'skokhozyaystvennyy institut.
(Spectrum, Atomic)

MEN', A.N.

Determination of short-range order parameters for the first coordination sphere of unordered solid solutions. Fiz. met. i metalloved 11 no.3:347-352 Mr '61. (MIRA 14:3)

1. Institut metallurgii Ural'skogo filiala Akademii nauk SSSR.
(Crystal lattices)
(Solutions, Solid)

MEN', A.N.

Heat capacity of systems with a special additional parameter. Fiz. met. i metalloved. 12 no.1:158-160 Jl '61. (MIRA 14:8)

1. Institut metallurgii Ural'skogo filiala AN SSSR.
(Alloys--Thermal properties)

S/048/61/025/011/017/031
B104/B102

AUTHOR: Men', A. N.

TITLE: Determination of parameters characterizing the cation distribution in multicomponent spinels

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 11, 1961, 1385 - 1387

TEXT: The structure of spinels containing N_i ($i = 1,2,\ldots,n$) cations of kind i was studied. The cation distribution over tetrahedral and octahedral lattice sites is described by one parameter λ. The dependence of λ on the composition c_i is determined from a solution of the equation $dF/d\lambda = 0$, where $F = K(\lambda, c_i, T) - kT \ln w(\lambda, c_i)$. The author bases on his own experimental results (Fizika tverdogo tela; in print) regarding the relation $\lambda = \lambda(c_i)$, to represent the equation:

$$\frac{d \ln w}{d \lambda} = \frac{1}{kT} \frac{dK}{d\lambda},$$

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derived from the relations indicated above, in the form

$$\frac{\lambda_1(3c_2-1+\lambda_1+r)}{(1-\lambda_1-r)(3c_1-\lambda_1)}=\alpha_1,$$
$$\frac{\lambda_2(1-3c_1+\lambda_2-r)}{(3c_1-\lambda_2)(3c_1+3c_2-1-\lambda_2+r)}=\alpha_2, \qquad (7)$$

where

$$\lambda_1=\frac{N_1^A}{N};\quad \lambda_2=\frac{N_1^B}{N};\quad c_i=\frac{N_i}{3N};$$
$$r=\frac{1}{N}\sum_{i=3}^{h}N_i^A;\quad \sum_{i=1}^{n}N_i=3N. \qquad (5)$$

$$\alpha_i=\exp\left\{-\frac{f_i}{kT}\right\},\qquad f_i=f_i(\lambda c_i T)=\frac{dK}{d\lambda_i}. \qquad (8)$$

If, for the case $\lim_{T \to 0} \alpha = 0$, f is independent of λ (low temperatures), it follows:

$$\lambda_i = \frac{1}{2(1-\alpha)}\left[-(a_i + \alpha b_i) + \sqrt{(a_i + \alpha b_i)^2 + 4\alpha(1-\alpha)d_i}\right], \tag{9}$$

$$a_1 = 3c_2 + r - 1, \quad a_2 = 1 - 3c_1 - r;$$
$$b_1 = 3c_1 + 1 - r, \quad b_2 = 6c_1 + 3c_2 - 1 + r;$$
$$d_1 = 3c_1(1-r), \quad d_2 = 3c_1(3c_1 + 3c_2 - 1 + r).$$

For the case of high temperatures,

$$\lambda_1 \approx \frac{1-r}{1-\sum_{i=3}^{n} c_i} c_1, \qquad \lambda_2 = 3c_1 - \lambda_1. \tag{11}$$

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is obtained. The proposed function $f(\lambda)$ is well satisfied for the systems $Fe_{1-\lambda}Mg_{\lambda}(Fe_{1+\lambda}Mg_{1-\lambda})O_4$; $MgFe_{2-c}Mn_cO_4$ $(0.8 \leqslant c \leqslant 1.2)$, and $Fe_{1-\lambda}Ti_{\lambda}(Ni_{1+c}Fe_{1-2c+\lambda}Ti_{c-\lambda})O_4$. In case of magnesium ferrite, a good agreement with experiment is attained if f is taken as a linear function of λ. Experimental results concerning the system $N_{1+c}Fe_{2-2c}Ti_cO_4$ are in good agreement with theoretical data if f is taken as a linear function of λ and of c. There are 1 table and 13 references: 9 Soviet and 4 non-Soviet. The two most recent references to English-language publications read as follows: Kriessman C. J., Harrison S. F., Phys. Rev., 103, 857 (1956); Neel L., Ann. Phys., 3, 137 (1948).

ASSOCIATION: Institut metallurgii UFAN SSSR (Institute of Metallurgy of the Ural Branch of the Academy of Sciences USSR)

33337
S/181/62/004/001/003/052
B102/B138

24.7100 1144 3108

AUTHOR: Men', A. N.

TITLE: Cation distribution in multi-component spinel

PERIODICAL: Fizika tverdogo tela, v. 4, no. 1, 1962, 14 - 21

TEXT: Formulas are derived for the concentration and temperature dependence of the parameter $\lambda_j = N_j^{\mu}/N$ for a spinel-type lattice containing N_i cations in tetrahedral (A) and octahedral (B) sites. N_i^{μ} is the number of i-atoms in μ (μ = A,B) sites; $N_i^A + N_i^B = N_i$ ($i = 1,2...n$). The subscript j runs from 1 to n-1. At T=0, $\lambda_j = 0$. $\lambda_j(T,c_i)$ is sought, $c_i = N_i/N$. For $\lambda_j(T,c_i)$ a set of n-1 equations is obtained:

$$\frac{\lambda_j(d_1+\lambda_j)}{(c_j-\lambda_j)(d_2-\lambda_j)} = a_j \quad (j=1, \ldots, n-1), \quad (6).$$

$$\left.\begin{aligned} a_j &= \exp\left\{-\frac{1}{NkT}\frac{\partial U}{\partial \lambda_j}\right\}, \\ d_l &= b_l + \sum_{i=1}^{n} a_i c_i + \sum_{i=1}^{n} t_i \lambda_i. \\ (l &= 1, 2) \qquad (i \neq j) \end{aligned}\right\} \quad (7).$$

Card 1/3

Cation distribution in...

For example, for the system $Fe_{1-\lambda}Mg_{\lambda}(Fe_{1+\lambda}Mg_{1-\lambda})O_4$

$$\frac{\lambda(1+\lambda)}{(1-\lambda)^2} = e^{-\frac{1200}{T}}. \qquad (10)$$

is found, and for $Fe_{1-\lambda}Ti_{\lambda}[Ni_{1+\sigma}Fe_{1-2\sigma+\lambda}Ti_{\sigma-\lambda}]O_4$

$$\frac{\lambda(1-2\sigma+\lambda)}{(1-\lambda)(\sigma-\lambda)} = e^{-\frac{U_1}{kT}}. \qquad (11).$$

For $U_1/kT = 0.96$, the results agree with experiment. For spinels of type XZ_2O_4 which may be normal or inverse at T=0, $\lambda_{inv.} = \frac{-(1+2\alpha)+\sqrt{1+8\alpha}}{2(1-\alpha)}$ (L. Neel, C. R. 230, 190, 1950); $\lambda_{norm.} = \frac{-3\alpha+\sqrt{8\alpha+\alpha^2}}{2(1-\alpha)}$ where $\alpha = \exp(-U_1/kT)$. At $T=T_0$, $d\lambda/dT$ has a maximum, $T_0 = U_1/kx_0$, where

$$\alpha[x_0(1+\alpha)-2(1-\alpha)]-x_0\alpha(b+3\alpha^{1/2})=0, \qquad (16)$$

and $a_{n.} = 4+5\alpha$, $b_{n.} = 8\alpha + \alpha^2$; $a_{inv.} = 5+4\alpha$, $b_{inv.} = 1+8\alpha$. Numerical

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Cation distribution in...

solution yields $(x_o)_{inv.} \simeq 2.75$, $(x_o)_{n.} \simeq 4.85$. U_1 may be defined as the activation energy of an elementary event of cation diffusion, $T_o \simeq 440°K$, $(U_1)_{inv.} \simeq 0.07$ ev. For $\lambda(T)$ at $T=T_o$, $(U_1)_{n.}/(U_1)_{inv.} = 1.8$, $\lambda_{inv.}(T_o) = 0.064$, $\lambda_{n.}(T_o) = 0.008$. In the following, the system $X_cY_{1-c}Z_2O_4$ is treated analogously, the results are tabulated. There are 1 figure, 4 tables, and 19 references: 11 Soviet-bloc and 8 non-Soviet-bloc. The four most recent references to English-language publications read as follows: A. Miller, J. Appl. Phys. Sup. 30, No. 4, 249, 1959; J. B. Goodenough, A. L. Loeb. Phys. Rev. 98, 391, 1955; C. J. Kriessman, S. F. Hairison. Phys. Rev. 103, 857, 1956; K. Muramori, S. J. Miyahara, J. Phys. Soc. Jap. 15, 2354, 1960.

ASSOCIATION: Institut metallurgii UFAN Sverdlovsk (Institute of Metallurgy of UFAN, Sverdlovsk)

SUBMITTED: May 24, 1961 (initially),
June 13, 1961 (after revision)

Card 3/3

S/181/62/004/004/009/042
B108/B102

AUTHOR: Men', A. N.

TITLE: Concentration and temperature dependences of the correlation parameters of a three-component spinel

PERIODICAL: Fizika tverdogo tela, v. 4, no. 4, 1962, 889 - 895

TEXT: The author establishes the correlation parameters of a three-component spinel with the composition $X_cY_{1-c}Z_2O_4$ for which the distribution with respect to the sublattices is determined by the probability of finding a certain cation at a definite lattice site. Extensive formulas are derived, which cannot be presented in this abstract. There are 1 figure, 3 tables, and 10 references: 7 Soviet and 3 non-Soviet. The three references to the English-language publications read as follows: N. Miyata. J. Phys. Soc. Jap., 16, 206, 1291, 1961; J. M. Hastings, L. M. Corliss. Phys. Rev., 104, 328, 1956.

ASSOCIATION: Institut metallurgii UFAN SSSR, Sverdlovsk (Institute of Metallurgy of the Ural Branch AS USSR Sverdlovsk)

SUBMITTED: November 9, 1961

Card 1/1

44174

24.6110

S/181/62/004/012/023/052
B104/B102

AUTHORS: Men', A. N., and Naysh, V. Ye.

TITLE: The term splitting in multicomponent disordered crystals

PERIODICAL: Fizika tverdogo tela, v. 4, no. 12, 1962, 3522-3525

TEXT: The theory of term splitting in crystals, developed by Bethe (Ann. de Phys., 3, 133, 1929) is extended to multicomponent disordered crystals. It is assumed that a multicomponent crystal comprises N sites. In the case of n types of atoms, N_t ($t = 1,2,\ldots n$), $\sum_t N_t = N$ holds. Each site is characterized by a set M of four symbols ($ikl\alpha$). i characterizes the color (the type of atom) of the point, k the number of atoms of a given type, l the spatial distribution of the other points with respect to the one considered and α gives the condition that among sites of equal color there may be such as have different magnetic moments. l(R) characterizes an island in space which is bounded by a sphere of radius R. M is the set of all sites, whilst the set $M_j(i,k,l)$ of all sites of the same type is a

Card 1/2

The term splitting in multicomponent ...

subset of M. A sequence $R_{min}^{(j)} < R_1^{(j)} < R_{max}^{(j)}$ is obtained if one point is connected by rays with the remaining sites and if the distances apart of two sites are ordered. $1(R_{i1}) \lesssim 1(R_{i2})$ holds for the symmetries $1(R_{ik})$ of the island if $R_{i1} < R_{i2}$. If the symmetry $1(R_{max})$ is known, it becomes possible to find a limiting radius $(R_i)_{limit}$, for which $1(R_i) = 1(R_{max})$. Thus the problem is reduced to finding the symmetry of the islands, starting from $1(R_{min})$. The problem is solved for spinel and garnet structures. It is shown that for spinel-type structures that have tetrahedral lattice sites the character of the term splitting is completely explained if due consideration is given to the immediate neighborhood, whereas in the case of octahedral lattice sites two coordination spheres must be considered. There are 1 figure and 2 tables.

ASSOCIATION: Institut fiziki metallov AN SSSR, Sverdlovsk (Institute of the Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: July 9, 1962

S/070/62/007/003/003/026
E132/E460

AUTHORS: Izyumov, Yu.A., Men', A.N.

TITLE: On the theory of the scattering of slow neutrons in solid solutions having the spinel type of structure in its dependence on composition and degree of inverseness

PERIODICAL: Kristallografiya, v.7, no.3, 1962, 358-361

TEXT: Theoretical formulae are derived determining the effective cross-section for the scattering of slow neutrons in solid solutions of the spinel type. Spinels are of two types, normal and inverse which differ in the arrangement of the cations. The coherent component of the scattering is calculated but not the incoherent part. The formulae are useful for measuring the proportions of the cations which are in octahedral and tetrahedral interstices.

ASSOCIATIONS: Institut fiziki metallov AN SSSR (Institute of Physics of Metals AS USSR); Institut metallurgii Ural'skogo filiala AN SSSR (Institute of Metallurgy of the Ural Branch AS USSR)

SUBMITTED: June 17, 1961

Card 1/1

MEN', A.N.

Calculating short-range order in spinel-type structures. Fiz. met. i metalloved. 13 no.6:808-816 Je '62. (MIRA 15:7)

1. Institut metallurgii Ural'skogo filiala Akademii nauk.
(Spinel group) (Crystal lattices)

S/076/62/036/011/001/021
B101/B180

AUTHOR: Men', A. N. (Sverdlovsk)

TITLE: Theory of redox equilibrium in oxides

PERIODICAL: Zhurnal fizicheskoy khimii, v. 36, no. 11, 1962, 2313 - 2316

TEXT: The solid solution investigated contains N_i atoms of the i ($i = 1....n$) type in the intersticial sites of a j-type lattice ($j = 1....m$) formed by close packed oxygen atoms. $\partial F/\partial N_i^j = 0$; $\sum_{i=1}^{n} N_i^j = N^j$; $\sum_{j=1}^{m} N_i^j = N_i$; $\sum_{i=1}^{n} w_i N_i = \text{const}$, where N^j is the number of sites in a j sublattice, w_i the valency of i-type atoms, and F the free configurational energy of the oxide. It is assumed that the i-type atoms can exist in not more than two valence states. The interaction with gaseous O_2 is given by:

$$A_{j,1}^{w_{A_1}} + O_2(w_{A_2} + w_{A_1})/4 = A_{j,2}^{w_{A_2}} + O^{2-}(w_{A_2} - w_{A_1})/2 + \beta_j \square_{jA}(w_{A_2} - w_{A_1})/2,$$

Card 1/4

Theory of redox equilibrium in oxides

where β_j is the ratio between the number of sites in the j and the oxygen sublattices; $\square_j$ are the vacancies in the j sublattice due to changes in the valency of the A atoms ($w_{A_2} > w_{A_1}$). K is the equilibrium constant of this reaction:

$$K = \lambda_{A_{j,2}^{w_{A_2}}} \lambda_{O^{2-}}^{(w_{A_2}-w_{A_1})/2} \lambda_{\square_j}^{\beta_j (w_{A_2}-w_{A_1})/2} / \lambda_{A_{j,1}^{w_{A_1}}}^{w_{A_1}} p_{O_2}^{(w_{A_2}-w_{A_1})/4}. \quad (4),$$

where λ are the activities defined by

$$\lambda_{A_{j,k}^{w_{A_k}}} = \exp\left\{\frac{1}{kT} \frac{\partial F}{\partial N_{A_{j,k}^{w_{A_k}}}}\right\}. \quad (6),$$

It is found that

$$\lg p_{O_2} = \frac{4}{w_{A_2} - w_{A_1}} \left\{ \frac{w_{A_2} - w_{A_1}}{2} \lg \lambda_{O^{2-}} - \lg K + \right.$$
$$\left. + \frac{1}{kT} \left[\frac{\partial F}{\partial N_{j,2}^{w_{A_2}}} - \frac{\partial F}{\partial N_{A_{j,1}}^{w_{A_1}}} + \frac{w_{A_2} - w_{A_1}}{2} \beta_j \frac{\partial F}{\partial N_{\square_{jA}}} \right] \lg e \right\}. \quad (7)$$

Card 2/4

Theory of redox equilibrium in oxides

where

$$\frac{\partial F}{\partial N_{A_f^{w_f}}} = \frac{\partial U}{\partial N_{A_f^{w_f}}} + kT\,(\ln N_{A_f^{w_f}} + 1)\ (f = 1, 2),$$
$$\frac{\partial F}{\partial N_{\square_A}} = \frac{\partial U}{\partial N_{\square_A}} + kT\,(\ln N_{\square_A} + 1). \qquad (10),$$

and $N^j_{i\,p_i} = \sum_{s=1}^{N_\Pi} a_s x_s + a_o$ $\left(p = \prod_{i=1}^{\pi}\right)$, where N_Π is the number of independent parameters. Hence

$$\frac{\partial \lg p_{O_2}}{\partial x_t} = \frac{4 \lg e}{kT\,(w_{A_3} - w_{A_1})} \left\{\sum_{f=1}^{2} (-1)^f b_{t_{A_f}} \left[\frac{\partial^2 U}{\partial N^2_{A_f^{w_f}}} + \frac{kT}{N_{A_f^{w_f}}}\right] + \right.$$
$$\left. + \frac{\beta\,(w_{A_3} - w_{A_1})}{2} b_{t_{A_\square}} \left(\frac{\partial^2 U}{\partial N^2_{\square_A}} + \frac{kT}{N_{\square_A}}\right)\right\} \quad (t = 1 \ldots N_\Pi), \qquad (13).$$

If magnesium oxide is added to wustite: $\log p_{O_2} = 4\{\log N_3 + 0.5 \log(N_1/N)$ $- \log 1KN_2 + (3/2) \log (N - N_1 - N_3/(N - (Z + 1)(N_1 + N_3))\}$, where

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S/076/62/036/011/001/021
B101/B180

Theory of redox equilibrium in oxides

$N_1 = N_{Fe^{2+}}$, $N_2 = N_{Fe^{3+}}$, $N_3 =$ [illegible], $N_4 = N_{Mg}$, Z is the coordination number, l, the number of valency states = 2, and K the equilibrium constant of the reaction: $Fe^{2+} + 0.25O_2 = Fe^{3+} + 0.5[illegible] + (1/2)O^{2-}$. Addition of MgO to wustite is thus favorable for the reduction of Fe^{3+}.

ASSOCIATION: Institut metallurgii Ural'skogo filiala AN SSSR (Institute of Metallurgy of the Ural Branch AS USSR)

SUBMITTED: December 27, 1960

Card 4/4

S/181/63/005/001/012/064
B102/B186

AUTHORS: Men', A. N., and Sokolov, A. V.

TITLE: Application of the theory of representation to ordering binary systems

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 78-80

TEXT: The ordering problems are discussed on the example of the $AuCu_3$ molecule with the Fm3m symmetry by taking account of the symmetry of central - symmetric molecules (symmetry group O_h). This is done on the basis of a theorem and a lemma described in this paper. Theorem: A finite set M of multicolored points M_i is assumed to be given (cf.Kristallografiya, 7,490,1962;FMM,14,315,1962). Each symmetry element of this set of points will then be contained in a symmetry group constructed for the corresponding totality of M_i single-colored points i from M. g is assumed to be an arbitrary symmetry element of group G of set M. By definition it is assumed that $gM=M$ or $g\sum_i M_i \equiv \sum_i gM_i = \sum_i M_i$ from

Application of the theory of ...

which it follows that $gM_i=M_i$. Lemma: the symmetry group G_i of the single-colored set of points M_i is assumed to be given. The symmetry group G of the set $M = \sum_i M_i$ then will be equal to the section $G_i (G=\cap G_i)$.

The totality of the common elements is called section of groups. It is proved that the contrary is not valid. On the basis of these conclusions the symmetry groups are determined for the 10 irreducible representations of the groups O_h and D_h. It is concluded that the nature of the spectrum of the central ion depends mainly on the type of the node of the ordered alloy and, within two spheres, not on more distant neighbors. There are 2 figures and 1 table.

ASSOCIATION: Institut metallurgii Ural'skogo filiala AN SSSR (Institute of Metallurgy of the Ural Branch of AS USSR); Institut fiziki metallov AN SSSR, Sverdlovsk (Institute of the Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: July 17, 1962

Card 2/2

L 11156-63 EWT(1)/BDS--AFFTC/ASD--IJP(C)
ACCESSION NR: AP3000601 S/0181/63/005/005/1286/1290

56
54

AUTHOR: Men', A. N.; Polyakov, V. P.; Smolenskiy, G. A.; Chufarov, G. I.

TITLE: Effect of near order on the magnetic properties of ferrimagnetic substances with garnet structure

SOURCE: Fizika tverdogo tela, v. 5, no. 5, 1963, 1286-1290

TOPIC TAGS: ferrimagnetism, garnet, saturation magnetization

ABSTRACT: A study was made of saturation magnetization in solid solutions of garnet containing nonmagnetic ions in tetrahedral and octahedral sites. This study was made with proper calculations for effect of near order and was undertaken to refine the magnetization theory of Gilleo. A comparison was made between theory and experiment for a solid solution of (1-x)Y sub 3 Fe sub 5 O sub 12-xCa sub 3 Fe sub 2 Si sub 3 O sub 12. This comparison is shown graphically in Fig. 1. It was found that calculations involving near order produce a shift in points at the extremes of the curve representing the relation of saturation magnetism to concentration. Comparison of theory with experiment may define two parameters, proposed in theory, that relate the energies of paired interactions. Orig. art. has: 1 figure and 23 formulas.

Metallurgical Inst. UFAN; Institute of Semiconductors, Academy of Sciences

Card 1/4

KURUSHIN, Yu.N.; MEN', A.N.

Determining the temperature and concentration dependences of the short-range order parameters for an n-component unordered solid solution. Ukr. fiz. zhur. 8 no.2:175-179 F '63. (MIRA 16:2)

1. Institut metallurgii Ural'skogo filiala AN SSSR, Sverdlovsk.
(Solutions, Solid)

KURUSHIN, Yu.N.; MEN', A.N.

Determining short-range order parameters for three-component spinels. Fiz. met. i metalloved. 15 no.2:161-165 F '63. (MIRA 16:4)

1. Ural'skiy lesotekhnicheskiy institut i Institut metallurgii Ural'skogo filiala Akademii nauk SSSR.
(Spinel group) (Crystal lattices)

L 33190-66 EWT(1)/EWT(m)/EWP(t)/ETI IJP(c) JD/AT

ACC NR: AR6016169 SOURCE CODE: UR/0058/65/000/011/D003/D003

AUTHORS: Druzhinin, V. V.; Kurushin, Yu. N.; Men', A. N.; Neyah, V. Ye.; Nikiforov, A. Ye.; Cherepanov, V. I.

TITLE: Contribution to the theory of energy spectra of paramagnetic ions in certain oxides

SOURCE: Ref. zh. Fizika, Abs. 11D16

REF SOURCE: Tr. Komis. po spektroskopii. AN SSSR, t. 3, vyp. 1, 1964, 514-519

TOPIC TAGS: paramagnetic ion, spectrum, ION ENERGY

ABSTRACT: Calculations are presented of the energy spectrum of a paramagnetic ion in a crystal with spinel structure in the approximation of the average intracrystalline field. It is shown that allowance for the field due to the second and farther neighbors can exert an appreciable influence on the interpretation of the spectra of such ions. Quantitative calculation results are presented for Cr^{3+} in $MgAl_2O_4$ and experimental data on this ion. [Translation of abstract]

SUB CODE: 20

Card 1/1 mc

L 20277-65 EWT(l)/EPF(c)/EPA(w)-2/EEC(t)/T/EWA(m)-2 Pr-4/Pab-10 IJP(c)/SSD(c)/ASD(a)-5/ASD(m)-3/AFWD(t)/ESD(t) WW

ACCESSION NR: AP4041690 S/0181/64/006/007/1939/1945

AUTHOR: Cherepanov, V. I.; Men', A. N.

TITLE: Contribution to the theory of the optical spectrum of Cr^{3+} ions in spinel

SOURCE: Fizika tverdogo tela, v. 6, no. 7, 1964, 1939-1945

TOPIC TAGS: optical spectrum, spinel, chromium, absorption band, level transition

ABSTRACT: Continuing an earlier investigation of the influence of the second-order neighbors on the splitting of the ^4F level of the ground state of an ion with d^3 configuration situated in the octahedral site of an ideal spinel structure (FTT, v. 5, 1630, 1963), the authors investigate in greater detail the splitting of the ^4F ground-state level of a Cr^{3+} ion situated in the octahedral site of spinel ($MgAl_2O_4$). More accurate formulas are obtained for the energy

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L 20277-65
ACCESSION NR: AP4041690

level by simultaneously considering the influence of fields with cubic and trigonal symmetry. The theoretical results obtained are used for a new interpretation of the origin of two broad optical absorption bands, which are related to quantum transitions due to the strong trigonal field of the second neighbors. Arguments are advanced for and against this interpretation during the course of comparison of the theoretical results with the experimental data. The need for additional research is indicated. Orig. art. has: 1 figure, 9 formulas, and 1 table.

ASSOCIATION: Institut metallurgii AN SSSR, Sverdlovsk (Institute of Metallurgy, AN SSSR)

SUBMITTED: 28Dec63 ENCL: 00

SUB CODE: SS, OP NO REF SOV: 004 OTHER: 011

Card 2/2

L 16151-65 EWP(e)/EWT(m) ESD(gs)/ESD(t)/RAEM(c)/SSD/BSD/AFWL/ASD(a)-5
WH

ACCESSION NR: AP4048402 S/0181/64/006/011/3288/3293

AUTHOR: Nikiforov, A. Ye.; Men', A. N.; Cherepanov, V. I.

TITLE: Contribution to the theory of the optical spectrum of bound pairs of impurity ions in a crystal

SOURCE: Fizika tverdogo tela, v. 6, no. 11, 1964, 3288-3293

TOPIC TAGS: Crystal impurity, impurity content, spectrum line, line shift, ion pair, ruby, spinel, energy spectrum

ABSTRACT: A group theory is used to calculate the energy spectrum of a pair of ions interacting by excitation exchange. The analysis shows that additional lines should appear near the line of each individual impurity ion with increasing impurity-ion concentration in the crystal. Specific calculations are made for a pair of Cr^{3+} ions in ruby and in spinel, for which experimental data are available. The estimates for ruby show that the shift of

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L 16151-65
ACCESSION NR: AP4048402

the additional lines relative to the R-line is on the order of 10^2--10^3 cm^{-1}, which agrees with the experimental data of A. L. Schawlow (J. Appl. Phys. v. 33, 395, 1962) for the N-lines in ruby. The sign of the displacement depends on the sign and direction of the difference of the dipole moments in the excited and ground states of the individual ion, and the sign of its charge. Since pairs with both directions are present in ruby, additional lines are to be expected within 10^2--10^3 cm^{-1} of both the short-wave and long-wave sides of the R-lines. The need for additional theoretical calculations is indicated, especially in view of symmetry distortions that can be produced by thermal vibrations, higher-order neighbors, or various defects. Orig. art. has: 3 figures and 15 formulas.

ASSOCIATION: Ural'skiy gosudarstvenny*y universitet im. A. M. Gor'kogo, Sverdlovsk (Ural State University)

SUBMITTED: 28Jan64 ENCL: 00 SUB CODE: SS, OP
NO REF SOV: 006 OTHER: 008 ATD PRESS: 3146

Card 2/2

ACCESSION NR: AP4023384

S/0048/64/028/003/0430/0432

AUTHOR: Men', A.N.; Cherepanov, V.I.

TITLE: Energy spectrum of impurity paramagnetic ions in ideal spinel [Report, Symposium on Ferromagnetism and Ferroelectricity Held in Leningrad 30 May to 5 June 1963]

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.3, 1964, 430-432

TOPIC TAGS: spinel structure, paramagnetic ion, impurity ion, electron paramagnetic resonance

ABSTRACT: The splitting of the ground state of a paramagnetic ion having an incomplete 3d shell, present as an impurity in an ideal spinel structure, is discussed theoretically. Quantitative calculations were performed for Cr^{3+} in $MgAl_2O_4$, and the results are compared with optical and electron paramagnetic resonance (EPR) data of other workers. The calculations were performed by treating the average field of the crystal as a perturbation. In order to discuss ions having the $3d^n$ configuration with n = 1,...4, 6,...9, it was necessary to consider only a single D term and a single F term. Diagrams are given showing the nature of the splitting of these two

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ACCESSION NR: AP4023384

terms in each of the three possible locations in the lattice. The splitting of an F term in the octahedral position was calculated quantitatively for Cr^{3+} in $MgAl_2O_4$. The effective nuclear charge for the 3d wave functions was obtained from the experimental ionization potential. Optical absorption by magnetic dipole transition should occur at wave numbers 15,000, 23,400 and 36,500 cm^{-1}. The two strongest of these absorptions coincide in order of magnitude with the absorption peaks observed by S.V. Grum-Grzhimaylo (Zap.Vses.mineral.o-va,Vtoraya seriya,87,vy*p.2,1929 (1958)) at 18,000 and 25,000 cm^{-1}. To compare the calculated level splitting with EPR data, the spin Hamiltonian of H.H.L.Pryce (Proc.Phys.Soc.,A,63,25,1950) was employed. With this it is possible to deduce the spin-orbit coupling constant from combined optical and EPR data. The EPR data of R.Stahl-Brada and W.Low (Phys.Rev.,116,No.3,561, 1959) give a value of 88 cm^{-1} for the coupling constant. This is in good agreement with the value of 91 cm^{-1} for the free ion. The EPR data of V.A.Atsarkin (Zhur.eksp. i teor.fiz.,43,No.3(9),839,1962) yield a coupling constant of 120 cm^{-1}, and are therefore not consistent with the optical data nor with the present calculations. Orig.art.has: 4 formulas and 3 figures.

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ACCESSION NR: AP4023384

ASSOCIATION: Institut metallurgii Ural'skogo filiala Akademii nauk SSSR (Institute of Metallurgy, Ural Branch, Academy of Sciences, SSSR); Ural'skiy gosudarstvenny*y universitet (Ural State University)

SUBMITTED: 00	DATE ACQ: 10Apr64	ENCL: 00	
SUB CODE: PH	NO REF SOV: 002	OTHER: 004	

Card 3/3

L 21064-65 EED-2/EWT(l)/EWT(m)/EWP(b)/T/EWP(t) AFWL/SSD/ASDC(a)/AS(mp)-2/SSD(dp) JD

ACCESSION NR: AP4044888 S/0020/64/157/006/1441/1444

AUTHOR: Men', A. N.; Stafeyeva, N. M.; Bogoslovskiy, V. N.; Zhuravleva, M. G. Chufarov, G. I. (Corresponding member AN SSSR)

TITLE: Concerning the determination of the concentration dependence of some thermodynamic functions of solid solutions of ferrites

SOURCE: AN SSSR. Doklady*, v. 157, no. 6, 1964, 1441-1444

TOPIC TAGS: thermodynamic function, solid solution, ferrite, concentration dependence, configurational mixture entropy

ABSTRACT: The statistical computation of thermodynamic functions of solid solutions is complicated because of the large number of parameters which characterize the interactions of particles in the solid phase. Therefore, reasonable approximations are needed which give a good agreement with the experiment. The simplest statistical approach is the computation of the configurational entropy of a mixture without consideration of the near order. The change of the configurational entropy $\Delta S^{cont.}$ for the solid solutions of copper ferrite at a given concen-

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tration c with copper magnetite is given as a function of the equilibrium degree λ of inversion of solid solution at a given temperature and λ_c of the inversion of copper ferrite at the same temperature. If the function $\lambda(c)$ is not known, it can be assumed, in the first approximation, that $\lambda = \lambda_c c$. For the calculation of ΔS^{cont}, the results of previous author's work (Fiz. tveral. tela, 4, 898 (1962)) are used. Orig. art. has: 3 figures and 12 equations

ASSOCIATION: Institut metallurgii Svepdlovsk (Institute of Metallurgy)

SUBMITTED: 20Apr64 ENCL: 00

SUB CODE: TD, MM NO REF SOV: 005 OTHER: 004

MEN', A.N.; STAFEYEVA, N.[illegible]; BOGOSLOVSKIY, V.N.; [illegible]; CHUFAROV, G.I.

Determination of the concentration dependence of some thermodynamic functions of solid ferrite solutions. Dokl. AN SSSR 157 no.6:1441-1444 Ag '64. (MIRA 17:9)

1. Institut metallurgii, Sverdlovsk. 2. Chlen-korrespondent AN SSSR (for Chufarov).

MEN', A.N.; STAFEYEVA, N.M.; BOGOSLOVSKIY, V.N.; ZHURAVLEVA, M.G.; CHUFAROV, G.I.

Thermodynamic analysis of equilibrium i. the dissociation of ferrites. Dokl. AN SSSR 156 no. 4:912-915 Je '64. (MIRA 17:6)

1. Institut metallurgii, Sverdlovsk. 2. Chlen-korrespondent AN SSSR (for Chufarov).

ZHURAVLEVA, M.G.; MEN', A.N.; CHUFAROV, G.I.

Determination of the concentration dependence of the activity of components for simple binary oxides. Dokl. AN SSSR 159 no.4: 879-881 D '64 (MIRA 18:1)

1. Institut metallurgii, Sverdlovsk. 2. Chlen-korrespondent AN SSSR (for Chufarov).

ANISHCHENKO, R.I.; NIKOLAYEV, A.P.; MEN', A.N.

Calculation of parameters characterizing the energy spectrum of impurity ions in crystal fields of various symmetry. Teoret. i eksper. khim. 1 no. 5:687-690 S-O '65 (MIRA 19:1)

1. Institut metallurgii, Sverdlovsk. Submitted July 5, 1965.

L 41177-65 EWT(1)/EWT(m)/EPR/EWP(t)/EWP(b) Ps-4 IJP(c) JD/JG
ACCESSION NR: AP5003451 S/0181/65/007/001/0282/0283

AUTHORS: Cherepanov, V. I.; Men', A. N.

TITLE: On the calculations of the parameters of the spin Hamiltonians of Cr^{3+} in $MgAl_2O_4$

SOURCE: Fizika tverdogo tela, v. 7, no. 1, 1965, 282-283

TOPIC TAGS: spin Hamiltonian, energy spectrum, chromium, magnesium compound, wave function, spinel

ABSTRACT: In an earlier paper (FTT v. 6, 1939, 1964) the authors calculated the energy spectrum of a Cr^{3+} ion placed in an octahedral site 16(d) of spinel, with account of the interaction between terms. Since the correct wave functions depend on the parameters b_i of the crystal field, the parameters of the spin-Hamiltonian are also functions of b_i. Formulas are derived for the spin-Hamiltonian parameters on this basis and are compared with the experimental

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L 41177-65
ACCESSION NR: AP5003451

2

data. The results show that account of the term interaction greatly influences the parameter D (abstractor's note: the symbols used are those of the earlier paper). Orig. art. has: 5 formulas and 1 table.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet (Ural State University); Institut metallurgii AN SSSR, Sverdlovsk (Institute of Metallurgy, AN SSSR)

SUBMITTED: 28Jul64 ENCL: 00 SUB CODE: SS, GP

NR REF SOV: 003 OTHER: 002

me

Card 2/2

L 25078-65 EWT(l)/EWT(m)/T/EWP(t)/EEC-2/EWP(b) IJP(c) JD

ACCESSION NR: AP5003452 S/0181/65/007/001/0283/0285

AUTHORS: Samokhvalov, A. A.; Men', A. N.

TITLE: Concerning the energy spectrum of the Fe^{2+} ion in connection with the electric conductivity of ferrite-spinels

SOURCE: Fizika tverdogo tela, v. 7, no. 1, 1965, 283-285

TOPIC TAGS: ferrite, spinel, electric conductivity, energy spectrum, iron

ABSTRACT: To explain the nature of the energy gap observed in ferrite-spinels between the ground (nonconducting) and excited (conducting) levels, amounting to 0.01~0.02 eV, the authors have calculated the level scheme of the divalent ion of iron placed in the octahedral site 16(d) of spinel, with account of the spin-orbit interaction. The calculations are based on an earlier paper by one of the authors (Men', with V. I. Cherepanov, FTT v. 5, 1630, 1963),

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L 25078-65

ACCESSION NR: AP5003452

and when the interaction of the terms is neglected, the value obtained for the gap is ≃0.01 eV. If the repulsion of the terms is taken into account, then the gap will be dependent on the composition and structure of the host lattice. Although the gap has been experimentally shown to increase noticeably with decreasing number of divalent iron ions, there are not enough data to calculate this dependence theoretically. Orig. art. has: 5 formulas.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics AN SSSR); Institut metallurgii AN SSSR, Sverdlovsk (Institute of Metallurgy AN SSSR)

SUBMITTED: 28Jul64 ENCL: 00 SUB CODE: SS,EM

NR REF SOV: 002 OTHER: 005

BRAYNINA, D.Z.; MEN', A.N.; CHUDAKOV, V.S.; CHUFAROV, G.I.

Calculation of the "stabilization" energy of iron group ions in oxides having a spinel structure. Dokl. AN SSSR 160 no.2:379-382 Ja '65. (MIRA 18:2)

1. Institut metallurgii, Sverdlovsk. 2. Chlen-korrespondent AN SSSR (for Chufarov).

L 62513-65 EWT(1)/EED-2

ACCESSION NR: AP5017342 UR/0181/65/007/007/2254/2256

AUTHOR: Chudakov, V. S.; Men', A. N.

TITLE: Calculation of the elastic binding coefficients and compressibility of spinels

SOURCE: Fizika tverdogo tela, v. 7, no. 7, 1965, 2254-2256

TOPIC TAGS: crystallography, spinel structure, spectrum analysis, elastic modulus

ABSTRACT: Elastic constants and compressibilities of some ferrites were calculated from the frequency spectrum of a spinel-type linear series. The values of the frequencies were obtained by using data from the literature. An analysis of the experimental data showed that for isomorphic displacement of one of the cations, the low frequency band of the infrared spectrum changed slightly and this resulted in oscillations of the lighter oxygen atoms in the spinel lattice. Theoretical and experimental results for the frequencies of spinel-type linear series were tabulated for Fe_3O_4, $NiFe_2O_4$, $CoFe_2O_4$ and $ZnFe_2O_4$; along with the force constants K_t and K_a, which were derived from the maximum and minimum frequencies of the infrared spectrum. The compressibility, $1/\beta$, was calculated from the following formula:

$$\frac{1}{\beta} = \frac{2C_3 k_0}{9a_0}$$

Card 1/3

ACCESSION NR: AP5017342

where a_0 is the lattice parameter and

$$C_3 = 12[\gamma - 4\gamma r_0 + 4(1+\gamma) r_0^2], \quad \gamma = \frac{k_T}{k_0}, \quad r_0 = \frac{\gamma}{2(1+\gamma)}.$$

Values of $1/\beta$ for some of the spinels are given in table 1 of the Enclosure. Calculations for the approximate linear model gave two collective values for the elastic constants, and thus for the theoretical calculation of compressibility. Orig. art. has: 2 tables.

ASSOCIATION: Institut metallurgii, Sverdlovsk (Institute of Metallurgy)

SUBMITTED: 03Mar65 ENCL: 01 SUB CODE: MMSS

NO REF SOV: 001 OTHER: 003

APPROVED FOR RELEASE: Wednesday, June 21, 2000 CIA-RDP86-00513R001033

L 62513-65
ACCESSION NR: AP5017342

ENCLOSURE: 01

TABLE 1
Force constants k_T and k_0

Ferrite	a_0, Å	Theory(10^5d·cm^{-1}) I		Theory(10^5d·cm^{-1}) II		Experiment(10^5d·cm^{-1}) [1]		Experiment(10^5d·cm^{-1}) [2]		Theory $\frac{1}{\beta}\cdot10^{12}$d·cm^{-2} I	Theory $\frac{1}{\beta}\cdot10^{12}$d·cm^{-2} II	$\frac{1}{\beta}\cdot10^{12}$
		k_T	k_0	k_T	k_0	k_T	k_0	k_T	k_0			
$NiFe_2O_4$	8.32	0.63	2.26	1.67	0.84	1.67	0.95	1.75	1.03	1.74	1.83	1.94
$CoFe_2O_4$	8.36	0.52	2.27	1.69	0.69	1.66	0.85	1.70	0.92	1.38	1.56	1.79
$ZnFe_2O_4$	8.42	0.42	2.17	1.72	0.53	1.48	0.92	1.29	1.03	1.14	1.39	-

Card 3/3

ZHURAVLEVA, M.G.; MEN', A.N.; CHUFAROV, G.I.

Statistical-thermodynamic aspect of spinel-type solid solutions.
Dokl. AN SSSR 163 no.1:144-146 Jl '65. (MIRA 18:7)

1. Institut metallurgii, Sverdlovsk.

BOGOSLOVSKIY, V.N.; MEN', A.N.; CHUFAROV, G.I.

Thermodynamic analysis of equilibrium in the dissociation of ferrites. Dokl. AN SSSR 163 no.3:671-673 Jl '65. (MIRA 18:7)

1. Institut metallurgii, Sverdlovsk. 2. Chlen-korrespondent AN SSSR (for Chufarov).