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Features of chemical structure, properties and technology of inorganic products based on oxides

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Abstract

For the first time within the framework of the developed system of chemical theoretical approach the use of methods of calculation of chemical bond components to determine the combined effect of composition and component ratio of the chemical bond (covalent character – C_C, metallic character – C_M, ionic character – C_I) on the structure (molecular or nonmolecular, etc.), state of aggregation, specific properties and technology of inorganic substances based on oxides was suggested. It was established that a predominantly covalent type of element-element bond ($C_C>C_M$) and element-oxygen ($C_C>C_M+C_I$) of raw materials and intermediate substances determines the oxidation-reduction, exothermal, catalytic nature of the chemical reactions of compounds in the production of oxides and acids. Ionic-covalent bond type of element-oxygen ($C_C>C_I>C_M$) predetermines a wide range of technological operations: high-temperature chemical processes of silicate formation and firing, physico-chemical (melting, amorphization) and mechanical processes (preparation of charge, various methods of moulding) in the technology of silicates. Mainly metallic type of element-element bond ($C_M>C_C$) and ionic type of element-oxygen bond ($C_I>C_M>C_C$) of initial substances determine the efficiency and predominant role of endothermal decomposition reactions in the production of oxides and physico-chemical (electrochemical) operations (electrolysis of aqueous solutions and melts) in the production of alkalis, etc. It was established that with the increase of covalent character and decrease of ionic character of the bond in oxides a natural change in their structure from non-molecular ionic to three-dimensional, two-dimensional, one-dimensional (linear) and low molecular weight, aggregate state (from solid to liquid and gaseous) and properties (from basic to amphoteric and acidic, etc.) occurs. This determines the specifics of technological processes (type, sequence, parameters) for the production of acids, salts, alkalis and other inorganic substances, silicate formation, amorphization, redox processes, absorption.

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