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The article discusses the physicochemical principles for the production of alumina cements based on nickel and cobalt spinel. The results of tetrahedration of the CaO–Al_2O_3–CoO– NiO system, which undergoes changes due to solid-state exchange reactions in the hightemperature region of the CaO–Al_2O_3–CoO subsystem at a calculated temperature of 1439 K, as well as the decomposition of the $Ca_3CoAl_4O_{10}$ ternary compound near 1530 K, are presented. Thermodynamic analysis establishes the stability of the conodes of the above system, allowing for its triangulation. Modifications of the subsolidus structure are combined and given for the temperature of 1530 K. All binary, ternary, and quaternary combinations thermodynamically stable in the subsolidus region of the system under study are presented. Topological graphs depicting the interconnection of elementary tetrahedrons, which allow the prediction of solid-state processes in multi-component systems, have been constructed. Based on the study of the structure of the CaO–Al_2O_3–CoO–NiO system, the possibility of technological forecasting of heterophase materials with high-performance characteristics is substantiated.

Keywords: multi-component system, solid-state exchange reaction, tetrahedron, ternary compound, topological graphs, prediction.