FEATURES OF THE SYNTHESIS OF TICAL (FE2O3 / TIO2) METAL MATRIX COMPOSITES UNDER NONEQUILIBRIUM CONDITIONS *

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In recent years, materials containing MAX phases or MXenes have been of considerable interest. MAX-phases due to the combination of properties of metals and ceramics may be used in a wide range of applications - from medicine to engineering. MAX-phases are used as an additional phase in composites, but there are attempts to produce three-dimensional objects consisting entirely of MAX phases. Currently the coatings based on MAX-phases are successfully synthesized, or the blanks of simple form are obtained by classical powder metallurgy techniques.

The main problem at the stage of producing products of complex shape containing MAX phases is the low knowledge of the thermodynamics for such materials under various conditions. The study of the production methods and properties of two-dimensional materials called MXene, consisting of carbides, nitrides or carbonitrides of transition metals, is currently the main direction of scientific research in many universities and research institutes.

In the present work, the synthesis of composites in the Ti-C-Al, Ti-Al-C-Fe_2O_3 and Ti-Al-C-TiO_2 systems, which is accompanied by the formation of MAX phases and intermetallic compounds with different properties, is studied theoretically and experimentally.

An attempt was made to determine under what conditions (and for which the compositions of the starting powder compositions) composite powders with fundamentally different properties are formed, caused by not only the inclusion properties, but also the matrix structure. Including, the result of the synthesis is a metal matrix composite or ceramic composite depending on the composition of the initial powders. Using metallothermal reactions to obtain composites with oxide inclusions (the system Ti-Al-C-Fe_2O_3 and Ti-Al-C-TiO_2) results in appearance of the non-equilibrium phases that not predicted from preliminary thermodynamic evaluation. Additional research of the reasons and conditions of their formation made it possible to establish a reduced transformation scheme and formulate a model for composites synthesis under sintering.

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