THE STUDY OF PHASE FORMATION IN THE SYSTEM OF IRIDIUM - SILICON CARBIDE*

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Silicon carbide has a number of useful properties, such as high hardness, strength, abrasion resistance, high thermal conductivity, thermal shock resistance and high oxidative stability [1,2]. The combination of all these properties makes it an integral component of high-temperature materials. For various applications, for example, such as catalytic substrates, semiconductor and high temperature materials, silicon carbide is used in combination with platinum group metals [3,4]. Due to its high melting point (2466 °C), low oxidation rate, and low oxygen permeability at high temperatures, iridium is a promising component of high-temperature materials [5,6]. That is why the iridium – silicon carbide system is of particular interest. However, information on this system is very limited. Thus, the aim of the work is a physicochemical study of the processes of interaction of iridium with silicon carbide.

To achieve the goal, heat treatment was carried out in the temperature range from 1000 to 1900 ºC with a step of 100ºC of mixtures of iridium powders with three different types of silicon carbide powders. Mixtures were prepared with a molar ratio of the starting components of 3: 1 and 1: 1, respectively. It has been established that the reaction rate is affected not only by the particle size, but also by the presence of oxygen impurities in the starting components. As a result of the interaction, free carbon is released. The process is multi-stage and depends on the processing temperature. At 1000 ° C, the Ir_3Si phase is formed, the content of which increases to a temperature of 1300 ° C. Further heating to 1400 ºC leads to a decrease in the content of this phase and the formation of the IrSi, Ir_3Si_2 and Ir_2Si phases. In the range of 1500–1600 ºC, the formation of a liquid phase occurs, as a result of crystallization of which the phases IrSi, Ir_3Si_2, Ir_2Si are released. At 1800-1900 ° C, in samples obtained from finely dispersed powders of silicon carbide, with a ratio of the starting components 1: 1, the reaction ended with the formation of IrSi. In the samples obtained from finely dispersed SiC powders, with the ratio of the starting components 3: 1, the phases Ir_3Si, Ir_3Si_2 and Ir_2Si are observed. Samples obtained from coarse-grained silicon carbide powder exhibit all the phases listed above. Iridium silicide (Ir_2Si) was discovered that was not previously registered by other researchers. Silicides with a silicon content of more than 50 at. % not found.

Schemes for the interaction of iridium with silicon carbide will be discussed.

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* The work was supported by the Russian Science Foundation under grant No. 18-19-00075.