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OBTAINMENT OF TI–AL–C SYSTEM METAL MATRIX COMPOSITES

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The creation of new materials with high physical, mechanical and operational properties, which will ensure the necessary reliability of products in extreme conditions, is relevant for the development of modern technology. Unfortunately, the possibilities of obtaining them using traditional metallurgical methods have been largely exhausted. Therefore, an important challenge facing scientists and engineers is to develop physical principles for the creation of new materials. New materials can be obtained by high-energy preparation of powders and extreme high-speed effects of temperatures and pressures during consolidation by spark-plasma sintering (SPS). Such kind of treatment will allow obtaining materials with higher physico-mechanical properties than those obtained by traditional metallurgical methods. The studies have shown the possibility of creating metal matrix composites strengthened by MAX phases of the Ti-Al-C system by SPS consolidation of the charge after mechanic activation and HVED processing of titanium and aluminum powders in kerosene has been investigated. It is shown that the powder mixture prepared in the course of mechanic activation and the powder mixture obtained in the process of HVED processing in kerosene have a similar granulometric and phase composition and differ only in allotropic forms of carbon in their composition. The effect of allotropic forms of carbon on the formation of new phases in the SPS process is established. Thus, in the mechanically activated charge which contains graphite occurs the formation of the Ti3AlC2 MAX phase, and in the HVED-activated charge that contains C60 and C70 the Ti2AlC MAX phase and the Ti3AlC ternary carbide are formed. It is shown that the metal-matrix composite of the Ti-Al-C system that contains the Ti2AlC MAX phase and the Ti3AlC ternary carbide has a Vickers hardness of 7 GPa, which is almost 2 GPa higher than for the samples that contain the Ti3AlC2 MAX phase (5.1 GPa).

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