

Nanocomposites and nanomaterials

Compacting materials based on MAX phase by impulse loading method

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A manufacturing process of experimental samples compacts for powders based on Ti-Al-C system MAX phases, namely Ti₂AlC and Ti₃AlC₂, by the method of pulse compression with using industrial low blasting explosives was designed. The powders were synthesized at the Institute of Superhard Materials by the free sintering in a vacuum at 1350 °C with different duration time delay. The parameters of shock wave loading are: detonation velocity $D=4 \times 10^3$ m/s, pressure about 2.5 - 3.5 GPa. Six samples were produced from powder compacts based on the MAX phases: two samples with Ti₂AlC composition and four samples with Ti₃AlC₂ composition. There is a slight change in the phase composition of the samples for Ti₂AlC formula (in the range of 10 wt.%). The content of the MAX phase remains above 90 wt.%. There is a partial destruction of the 312 phase and the formation of the Ti₂AlC under the action of the shock-wave loading (in the range of 0.2 to 17 wt.%) in the samples containing Ti₃AlC₂. The weight content of Ti₃AlC₂ phase is maintained at more than 78 wt.%. All the compacts obtained have the values of density in the range of 3.3 to 3.8 g/cm³, but these values are significantly different from the theoretically attainable density of MAX phases and indicate a relatively high level of porosity (more than 13%).

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