COMBUSTION SYNTHESIS IN MECHANOACTIVATED FeTi+C POWDER MIXTURES*

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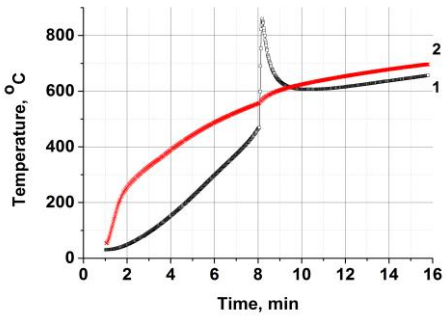
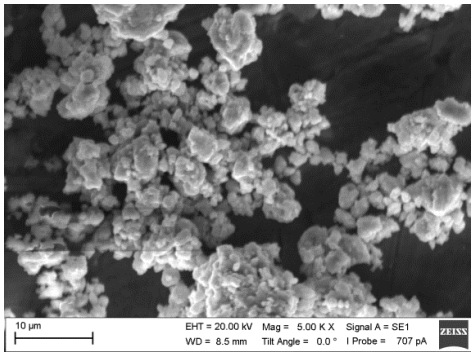
Metal-matrix composites (MMC) “titanium carbide - iron binder” are widely used as materials of wear resistant coatings and cutting tools because of their relatively lower cost and high mechanical properties [1, 2]. Self-propagating high temperature synthesis (SHS) seems to be highly productive and economical method to obtain MMCs from titanium, carbon and iron powder mixtures [3]. However, the incompleteness of TiC chemical reaction in SHS products and subsequent decrease of mechanical properties is observed. Combustion synthesis negates chemical reaction incompleteness due to prolonged heating, but the TiC grain coarsing can take place. Grain growth can be slowed down by increased inert additive content. But excess inert binder content can completely inhibit wave propagation in SHS and combustion process in furnace method. The mechanical activation (MA) of powder mixtures can extend the inert binder concentration limits for SHS wave mode and initiate combustion [4].

The MA of FeTi35C5 and carbon black powder mixtures were held. It was shown, that depending on processing time the coherent scattering regions (CSR), lattice micro distortions and specific surface area are affected. The combustion synthesis in MA FeTi+C powder mixtures were carried out in cylindrical air-tight reactor with Ar media, placed into preheated to 800°C oven. The temperature were measured by the thermocouples inside the titanium cylindrical cup filled with reaction powder mixture and on the outer reactor surface.



a



b

Fig.1. Temperature measurement results (a) in thermal explosion mode: 1 – powder mixture; 2 – furnace; (b) loose conglomerates in crushed MASHS product (88 g, 20 : 1, τ = 10 min).

According to XRD results there are next phases appear: TiC the - main phase, α-Fe solid solution and minimum of unreacted ferrotitanium. Comparing to SHS products XRD results [5] it was concluded, that MA and subsequent combustion synthesis negates the TiC reaction incompleteness and combustion synthesis appear to provide MMC with submicron TiC grains in Fe-based binder.

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*This work was carried out in the framework of Program for basic research in state academies of sciences (line of research III.23) and financially supported by the Russian Foundation for Basic research (project no. 18-32-00330).