Nanocomposites and nanomaterials

Structure and microhardness of iron-carbon nanotubes nanocomposites obtained by mechanochemical activation of components

S.L. Revo, M.M. Melnichenko, M.M. Dashevskyi, N.M. Belyavina, K.O. Ivanenko, T.G. Avramenko

Taras Shevchenko National University of Kyiv, 64/13, Volodymyrska Street, 01601 Kyiv, Ukraine.
E-mail: s_revo@i.ua

The paper considers the effect of obtaining and processing of nanocomposites material (NCM) precursors with iron and multiwalled carbon nanotubes (MWCNTs - 10, 20 and 30 vol.%) on its structure and microhardness. The criteria of processing of nanocomposites powder mixtures and their precursors are optimized. This ensures uniform distribution of components in the volume of compositions, effective grinding of MWCNTs agglomerates and optimization of their practically important characteristics.

It is shown, that mechanochemical activation of a powder mixture with iron and MWCNTs allows us to predictable change morphology of particles and phase composition of mixtures. In the initial stages of processing - it is a solid solution on the base of α-Fe. With an increase in the processing time, its grating period changes ambiguous. Due to X-rays, no presence of carbon nanotubes was found in the samples. At the same time, after 180 minutes of processing in a grinder the solubility of carbon in α-Fe was reached 5.8 at.%. The increase in the time of mechanical activation of burden on the base of iron and MWCNT (30 vol.%) up to 300 minutes allows to obtain iron carbide Fe_3C. Finally, mechanical activation of Fe-MWCNT burden contain α- (Fe, C) and γ- (Fe, C) solutions and products of the reaction of components - carbides Fe_3C and Fe_7C_3. In addition, there is some amount of FeO in compositions. After sintering in the mold at a temperature of 850°C and pressure of 8 GPa microhardness of samples is about 10 GPa.