Structure and mechanical properties of aluminum after shock-wave compaction

Vorozhtsov S.A., Kulkov S.N. and Komarov V.F.

The formation of the structure and properties of materials based on aluminum after shock-wave compaction was studied. Found that shock-wave treatment of aluminum powder and powder mixtures Al +10 wt.% C (in the form of detonation diamonds) and Al +10 wt.% Al_2O_3 produces samples with almost the theoretical density. The studied parameters of the fine crystal structure showed that the crystallite size of the main phase of aluminum in all cases, about 80 ± 10 nm, which is close to the size of the crystallites in the powder of aluminum in the initial state. X-ray diffraction studies showed that the samples with the addition of carbon and aluminum oxide formed aluminum two-phase state with a significantly different structure parameters: the size of the crystallites formed phase with detonation diamonds about 13 ± 5 nm, and with aluminum oxide nanopowder 8 ± 5 nm. In this case, the lattice parameter of nanophase increased by 0.5%, which testifies to its equilibrium state. This increase of the parameter may be due to compressive stress, evaluation of which gives the value of 350 MPa. Shown that the materials have high values of mechanical properties - hardness, compressive yield strength. It is shown that the hardness and yield strength of materials obtained by shock-wave treatment increased almost 10-fold compared to commercially pure aluminum.