Nanocomposites and nanomaterials

Arming affect of aluminum alloys with nanoscale nonmetallic particles

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The methods for incorporation of nanoscale particles with metallic melts were developed in PTIMA NAS Ukraine. The peculiarities of base alloy's composition, alloying elements, temperature and refining affects on the interaction processes of particles with the melt were stated. The affect of nanoscale carbides, nitrides and oxides particles at the structure and physico-mechanical properties of the aluminum matrix is investigated. The fact of the nanoparticles efficiency for solid structure particulation and dispersion hardening is ascertained.

It is shown that the maximum hardening of aluminum matrix alloys achieved with particles' size 10 - 50 nm. The modification effect is achieved within the modifier particles are structurally coherent (have the same crystal structure and lattice parameters) to the base alloy. Nonmetallic compounds such as Tungsten carbide are proved to be effective modifiers for aluminum alloys with silicon. Thus, the nanoscale nonmetallic particles with similar structure to the corresponding crystalline alloys can be used as effective modifiers and tougheners for aluminum alloys. Nonmetallic modifiers are much more inert to metal melts than the metallic are. They not react within melt deoxidation process neither dissolve, so the effective quantity for modification effect is much less, it is long-term and stable even after numerous remelts. For nanoscale nonmetallic particles are typical: large specific surface, non layering under gravity force into mettalic melts and formation of uniform slurry.