

# Nanocomposites and nanomaterials

## Nanoparticles as sites for nucleation of acicular ferrite structure in steel

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Studies of low carbon steel alloyed by aluminum, titanium and nitrogen showed the presence of nanoparticles in the structure. In the analysis, it was found that the nanoparticles are carbonitride titanium Ti(C, N), aluminum nitride (AlN), and complex nanoparticles based on Ti(C, N) and (AlN). For particles of Ti(C,N) characteristic of FCC lattice ( $a = 0,424$  nm). For aluminum nitride AlN typical CH lattice ( $a = b = 0,311$  nm,  $c = 0,4979$  nm). Titanium carbonitride particles by size can be from 10 nm up to some microns, while the aluminum nitride particles have size around 80 nm, also have particle size from 250 nm to 1 micron.

Investigated nanoparticles are separated during cooling of steel when it is in a liquid state. Upon further cooling of steel during solidification the nanoparticles leads to a refinement of austenite grains.

At definite parameters of cooling rate in the steel takes place bainite transformation. During the bainite transformation investigated particles act like a substrate for the nucleation of acicular ferrite plates. As a result, in the steel formed a so-called interwoven structure.

It is well known that the interwoven structure has perspective mechanical and performance properties. Especially such a structure in the steel increased values of impact toughness and strength. The great interest in use of low-carbon low-alloy steel with the structure of acicular ferrite shows Carriage Building industry.

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