Особливості формування мікроструктури та механічних властивостей модифікованої наночастинками сталі 20, отриманої способом електронно-променевої плавки

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Abstract

Studied were the features of formation of microstructure and mechanical properties of steel 20, modified by nanoparticles of SiC-based complex modifier and reduced wolframite. It is found that wolframite interaction with thermally-expanded graphite leads to formation of complex Fe3W3C, W(N, C), FeC and Fe2Si carbides. Compositions based on powdered iron of PZhR-4M grade and synthesized master alloys were remelted by EBM method. Produced ingots were hot rolled at temperatures of 1000…600 °C with up to 90 % degree of deformation. After that the metal was subjected to water hardening from 870…970 °C temperatures and tempering at 500…650 °C temperatures. Yield limit values on the level of 800…1000 MPa at relative elongation of 15… 20 % were obtained. It was found that the mechanism of modifier action was revealed both in steel grain refinement and in realization of dispersion strengthening due to blocking of mobile dislocations by dispersed particles. It was experimentally confirmed that increase of the content of dispersed tungsten carbides in the test melts leads to a more obvious and stable effect of physical yield in the hardened state that may be regarded as an indicator of the presence of nanosized high-strength modifying phase. Ref. 15, Tabl. 1, Fig. 6.

Key words: electron beam melting; modifying; nanoparticles; yield limit; relative elongation; rolling; hardening; tempering; dislocations; Frank–Read source

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