Implementation of Carbon Nanostructures into the Metal Structure During Heat Treatment

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Carbon nanostructures (CNS), in particular due to their unique structure and properties, found various potential areas of application in advanced technologies [1]. One of the options in the use of CNS is adding them to the metal structure to improve mechanical strength. However, there are certain difficulties in adding CNS to the structure of any metal:

- different specific density;
- thermal stability, which for single-walled carbon nanotubes makes 1200°C, and for multi-walled ones makes 2000°C [2].

In the first case, CNS can float on the surface of the metal, and in the second case, the formation of carbides is possible.

For a better implementation of CNS into the metal structure the use of graphitized firing process of heat treatment is suggested. Steel is subjected to graphitized firing of heat treatment, where a more stable structure is formed in which graphite is formed instead of cementite. The formation of graphite requires large concentration of carbon fluctuations, significant derivation of iron atoms from the front of graphitization and significant addition of carbon atoms.

Steel is heated up to 860°C and kept for a long time to transfer hypereutectoid cementite into graphite, and then it is slowly cooled. The growth of graphite inclusions occurs as carbon is received and iron atoms are evacuated.

It is obvious that in the process of diffusion, adding CNS will allow them to come to the places of graphitization, and moderate steel heating temperature will prevent the reaction of carbon and carbide formation.

1. P.M. Ajayan, T.W. Ebbesen, *Rep. Prog. Phys*. **60** No10, 1025 (1997).
2. А.Г. Ткачев, И.В. Золотухин, *Аппаратура и методы синтеза твердотельных наноструктур* (Москва: Издат. Машиностроение: 2007).