Nanoobjects microscopy

Interphase nanoparticles of cementite in low-carbon steels

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The structure of low-carbon steel C = 0.17-0.22% was studied in the isothermal decomposition of supercooled austenite. The thickness of the samples did not exceed 0.25 mm. The cooling rate at the transformation temperatures 400 ... 500 C reached a value of 4000 C/s.

Using diffraction electron microscopy, interfacial precipitates of cementite particles were studied [1]. In this work, continuing studies of nano-particles of cementite, band-like diffraction contrast was detected on the particles, and on the electronogram the cementite reflexes were extended in one direction. Such an effect arises when diffraction occurs on thin plates parallel to the primary electron beam.

Indication of microdiffraction patterns together with analysis of darkfield images showed that the cementite particles are connected with the ferrite matrix by the Isachev Orientation ratio and the axis of the ferrite zone [110] is parallel to the axis of the cementite zone [103].

Interphase precipitation, of cementite [1] must obey the crystallographic correspondence of three phases: austenite, ferrite, cementite. In the decoded electron diffraction pattern, the cementite (010) plane is parallel to the plane of the ferrite (111) then, based on the Arbuzov-Kurdyumov orientation relationship, the cementite (010) plane should be parallel to the austenite plane (011). In this case, the ferrite plane (111) will be parallel to the austenite plane (011), which leads to the Kurdyumov-Sachs orientation relation.

Thus, microdiffraction studies have shown that:

1. Interphase precipitation, of cementite in low-carbon steels is formed when mutual orientational relationships between all phases are observed: austenite, ferrite, cementite.

2. In the case of a diffusion $\gamma \rightarrow \alpha$ transformation between ferrite and austenite, the Kurdyumov-Sachs orientation relation can be realized.

1. *Bol'shakov V.I., Suchomlyn G.D., Suchomlyn V.I.* Orientation relationships of the nano particles of cementite and ferrite in the decomposition of low-carbon austenite. // Book of abstracts "Nanotechnologies and Nanomaterials", Lviv. August 24-27, 2016