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ABSTRACT BOOK

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Investigation for the phase thansformations and phase composition of Fe-B-C system alloys

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The development of metal alloys with predicted physical and chemical properties has a great future. There is no information on phase composition and factors affecting it and structure of inclusions in low-boron Fe-B-C system alloys. Thereby, we investigate phase transformation and phase composition of boron Fe-B-C system alloys and effect of binding energy of atoms on phase formation in these alloys.

We ascertain the phase composition and phase transformations in alloys with boron and carbon content of 0.0001-0.2 % and 0,1-0.5 % (w.). Based on results of research of phase composition in Fe-B-C system alloys microstructure of alloy with carbon and boron content of 0.1-0.15 % and 0.0001-0.001 % (w.) consists of ferrite grains and finely-divided inclusions of iron boride Fe2B disposed on the boundaries of ferrite grains. When boron and carbon content of alloy is 0.001-0.002 % and 0.2 % (w.) microstructure of alloys includes α-iron and boron cementite Fe3(CB). With carbon and boron content increase over 0.4 % and to 0.2 % (w.) correspondingly microstructure of alloys contains α-iron solid solution with inclusions of boride Fe2B and boron cementite Fe3(CB). Moreover, on the boundaries of prior austenite grains and inside ferrite grains of alloys with carbon and boron content of 0.3-0.5 % and 0.01-0.2 % (w.) formation of multiphase inclusions consisting of three phases is revealed to be. In the center of inclusion there is boride Fe2B surrounded by boron cementite Fe3(CB) and its outer shell is cubic boron carbide Fe23(CB)6. When carbon content is over 0.4% and boron content is 0.2% (w.) we observe the formation of eutectics Fe+Fe23(CB)6 on the boundaries of pearlite grains. Inside pearlite grain the plane-faced inclusions of boride Fe2B are found. The analysis of results shows that when boron content is low (down to 0.001 % (w.)) and carbon content is prior to 0.1 % (w.), as well as when boron and carbon content is as small as 0.002 % and 0.3 %, alloys are of two-phase structure: ferrite and boride or ferrite and boron cementite, properly. With content increase of boron and carbon (over 0.002% and 0.3% (w.)) alloys are of three-phase composition: ferrite, boride Fe2B and boron cementite Fe3(CB).

It is known, that phase formation in alloy is related to binding energy of constituent compounds. To estimate the Fe-B, Fe-C and Fe-Fe binding energies we use quantum-mechanical calculations. The outcomes show that maximum energy is corresponded to iron-boron bond. Therefore, the probability of iron boride Fe2B formation is greater than that of boron and carbon bearing phases Fe3(CB) and Fe23(CB)6.