PHASE EQUILIBRIUMS OF PYRRHOTITE AND ANTAGONISM PHASES

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In practice often are investigated mineralogy multiphase rock samples, the properties of which are important for understanding the conditions of its formation, and for forecasting and mineral exploration, meaning that the economy and the development of the industry is difficult to overestimate. Although the phase composition of multicomponent systems usually studied in detail, but the interaction of phases in such systems practically are not known.

The effect antagonism phases of observed in iron sulfides transferred in a stable phase state after synthesis in vacuum (~ 1 Pa) at 1000 ° C. At initial samples in the narrow region S/Fe ≈ 1.00 was fixed one antiferromagnetic phase β_1 (FeS - troilite). In the range of 1.00 <S / Fe <1.03 were determined by the two phase antiferromagnetic - β_1 и β_2 ($Fe_{0.972}S$). Found that gradually changing the relative percentages of these phases depending on the sulfur content in the initial samples. When ratio S / Fe = 1.03 phase β_1 disappears and only phase β_2 remains. By increasing the content of sulfur, there is only one phase of type β_2, but the parameters of the unit cell of such a phase change gradually, depending on the percentage content of iron atoms in it. This corresponds to the range 1.03 <x <1.10 and compositions $Fe_{0.972}S$ - $Fe_{0.909}S$.

Further increase in sulfur content, together with the phase β_4 arises phase β_5 having a monoclinic crystalline structure, where the cation vacancies are totally ordered in even the basal planes.

Pyrrhotite, containing the maximum percentage of sulfur, has a composition $Fe_{0.847}S$. Further increase in the sulfur content occurs phase with face-centered cubic crystal structure. She has a composition of FeS_2 (pyrite). Gradually changing relative percentage of these phases depending on the sulfur content in the initial samples.

As a result of X-ray studies of the structure and phase composition pyrrhotines stable phase state obtained after 29 years of exposure, was fixed effect antagonism of phase, which is described below.

Pyrrhotite in stable state has a very narrow region of homogeneity. Composition of pyrrhotite ~ FeS, $Fe_{0.975}S$, $Fe_{0.950}S$, $Fe_{0.909}S$, $Fe_{0.875}S$ formed the field of stable phase.

Between areas of stable phase consisted mainly of a mixture of troilite and monoclinic pyrrhotite, with education, with increasing sulfur content in the samples of pyrite. With a small offset from the monoclinic pyrrhotite $Fe_{0.875}S$ towards more glandular in composition of samples (S / Fe <1.145) formed troilite. For example, the phase composition of the sample with a ratio S / Fe = 1.130: 95.3% $Fe_{0.875}S$ and 3.24% FeS. With a small offset from the troilite to less glandular composition of samples formed monoclinic pyrrhotite was observed. For example, the phase composition of the sample with a ratio S / Fe = 1.01: 7.61% $Fe_{0.875}S$ and 92.30 FeS%.

This is interesting because in the absence of antagonism phase it would be logical to expect a mixture of troilite (FeS) and hexagonal pyrrhotite composition $Fe_{0.975}S$ the displacement of troilite to less iron samples.

By moving from a monoclinic pyrrhotite ($Fe_{0.875}S$) towards a more glandular in composition of samples to be generated phase mixture consisting of monoclinic pyrrhotite and hexagonal pyrrhotite composition $Fe_{0.909}S$ was observed.

Thus, the intermediate phases formed only in a narrow range of compositions sufficiently precise contact with the ratio S / Fe, while all other phases disappeared. For example, a sample with a ratio S / Fe = 1.052 was almost 98% of hexagonal pyrrhotite composition $Fe_{0.950}S$. Moreover with S / Fe <1.052 and S / Fe> 1.052, as shown by the diffraction patterns, realized mixture $Fe_{0.875}S$ + FeS with different ratios of these components depending on the S / Fe. It is clear that the displacement on the composition of S / Fe <1.052 expected (in the absence of antagonism phase) mixture $Fe_{0.950}S$ + $Fe_{0.909}S$, and the displacement S / Fe> 1.052 - $Fe_{0.950}S$ + $Fe_{0.975}S$. However, the experiment shows that in practice this does not happen. Mean while, for monoclinic pyrrhotite and troilite sufficiently precise contact with the ratio of sulfur and iron observed a homogeneous composition. Consequently, pyrrhotite in a stable phase state of antagonism phases observed.

Interest is to trace the phase composition of samples of the mixture of troilite, pyrite and pyrrhotite monoclinic when the ratio of sulfur and iron. Age of pyrite in the samples increases almost linearly up to S / Fe = 1.8, but synthesize homogeneous pyrite failed - in the samples enriched with sulfur, always present together with pyrite pyrrhotite with monoclinic crystal structure and pure sulfur.

If the content of troilite samples can be approximated sufficiently well by an exponential function, the phase of a monoclinic structure has a complex dependence on the ratio of sulfur and iron in the samples.

Experimentally found that troilite, pyrite and pyrrhotite have no monoclinic antagonism and form the mixture into a wide range of compositions. It should also be noted that the phase of β_2 ($Fe_{0.975}S$) has a lower degree of antagonism to the phase of β_1 (troilite) as compared with other phases, hexagonal pyrrhotite. The phase diagram is shown in the form of partial overlapping areas coexistence of these phases.

Results of this work: the spectrum of states of equilibrium phase decreases as the exposure of synthetic pyrrhotite. Phase diagram of pyrrhotite in the stable phase state has by moving from a monoclinic pyrrhotite ($Fe_{0.875}S$) towards a more glandular in composition of samples to be generated phase mixture consisting of monoclinic pyrrhotite and hexagonal pyrrhotite composition $Fe_{0.909}S$ of compositions. The presence of antagonism between the equilibrium phase states in hexagonal pyrrhotite different composition.