through for both the temperature dependence of the long-range order parameter and for the phase-transition temperature [10]. In Fig. 3 we show: 1) the solubility curve, 2) the spinodal for an equiatomic bcc alloy calculated in the model of nearest-neighbor interactions using (2).

The theory of atomic ordering considered here, which is based on a modification of the Kirkwood method and uses an ensemble different from the canonical ensemble, takes into account both intraphase and heterophase fluctuations and yields a single expression for the free energy of the B2 and B32 phases and also decomposition of the alloy. The improved treatment of the fluctuations results in a more accurate description of the phase transitions.

LITERATURE CITED


NUCLEATION CENTERS AND WAVE SCHEMES OF MARTENSITE GROWTH
IN IRON ALLOYS

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The relationship between the geometry of defects, wave schemes of growth of a martensite crystal (MC), and the orientation of the habit plane of the MC is discussed within the framework of the concept of heterogeneous nucleation. It is shown for Fe-Ni and Fe-Mn systems that a growth scheme governed by quasi-longitudinal waves is consistent with the model of a cylindrical nucleus oriented near the <110> and <211> (or <001>) directions characteristic of straight austenite dislocation lines. The possibility of influencing the course of the transformation by simulating nucleation on the surface of austenite is indicated. With regard to the system Fe-Mn, a description is offered of the transverse growth of a martensite plate for a two-dimensional nucleation center in a scheme which includes both longitudinal and transverse waves. The use of the wave approach to describe the growth of an MC in the form of a rod is discussed. Mention is made of the promise of using a nonlinear breather wave to model the dynamic state of the martensite nucleus and transverse growth of the martensite crystal.

1. In describing reconstructive martensite transformations (RMT) in iron alloys, it is customary to distinguish two stages during the transformation: nucleation and growth.® Understanding the nature of the martensite nucleation process is important for interpret-

®The accommodation of coexisting phases could be recognized as a third stage.
information on the structural, thermodynamic, and kinetic features of RMTs and for finding ways to influence the course of the transformation. However, since the first stage of RMT is difficult to observe directly, it has proven to be the least-studied stage to date. Nevertheless, any model which pretends to describe the growth stage presumes that the nucleation process follows a certain qualitative pattern. Refining this pattern should help in the construction of a physical model of a martensite nucleus. In the present study, such a refinement is attempted with regard to the orientation and form of the nucleus of the new phase on the basis of wave schemes of MC growth within the framework of the concept of heterogeneous martensite transformation. Thus, as in [1], by nucleus here we mean a region of austenite that is undergoing transformation and whose dynamic state is characterized by certain amplitudes of vibration of the atoms.

Following [1], we will connect the nucleation process with the fact that regions of short-range order of displacements (RSRD) existing (see [2], for example) below the equilibrium temperature $T_0$ of the phases are localized near defects. Knowing this, it is natural to expect the following to be true: a) the most likely nucleation centers will be individual defects (or their clusters) in the lattice of the initial phase;* b) the form of the nucleus (as the form of the localized RSRD) reflects the symmetry of the stress field near the defects. The latter statement implies a correspondence between the set of observed habit planes and the types of characteristic defects or clusters (pile-ups), since the combination of displacement waves controlling the formation of an MC in a given wave scheme of MC growth is connected with the spectrum of vibrations excited during nucleation. It should be noted that, given this pattern, the separation of the transformation process into stages of nucleation and growth is at best conditional in a kinematic description of an MC. Despite this, such a division is justified from the viewpoint of distinguishing different mechanisms responsible for the beginning of the transformation and its development.

2. In the case of a linear defect, represented by a straight section $A$ of a dislocation line, we can adopt (see [1]) the nucleus model in the form of a cylinder with the axis $e$ oriented along $A$, and we can use a scheme of growth of the nucleus based on two quasi-longitudinal waves propagating in noncollinear directions (LL-scheme). Then the formation of the martensite plate is interpreted as the attachment of a region, adjacent to the MC, which is becoming unstable due to the action of displacement waves [3]. In essence, this is a region of superposition of waves (within the framework of representations on a pair of displacement waves in the form of half-wave pulses with unbounded plane fronts) moving in the same direction and with the same velocity $C = C_1 + C_2$ as the line of intersection of the fronts of displacement waves propagating at the velocities $C_1$ and $C_2$. The thickness of the forming MC plate is determined by the transverse dimension of the nucleus, one of the linear dimensions of the lateral surface of the plate is determined by the length of the nucleus, and the second dimension is equal to the product of velocity $C$ and the time of growth (see Fig. 1). It follows from this that the section $A$ of the dislocation line which is collinear to the axis of the cylindrical nucleus is also collinear to the habit plane:

$$\langle A, N \rangle = 0,$$

where $N$ is the vector of a normal to the habit. This vector is one of the most important morphological characteristics of the crystal.

*The term "nucleation center" is conditional here and applies to imperfections in the austenite lattice that are not necessarily part of the volume of the nucleus.