NANOSTRUCTURE AND PHASE FORMATION UNDER SEVERE MECHANICAL TREATMENT OF Fe-BASED SYSTEM

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So far, the mechanism of phase formation under mechanical alloying and grinding is a subject of extensive studies.The results on nanostructure formation, mechanical alloying of Fe-based binary systems with interstitial (B, C) and substitutional (Al, Si, Ge, Sn) elements, deformation-induced dissolution of interstitial (Fe2B, Fe3C) and substitutional (FeSn) phases in α-Fe are presented in this report. The following scheme of nanostructural formation is considered: increasing of dislocation density → polygonization → dislocation pile-up → dynamic recrystallization (grain size L≈100 nm) → deformation twinning and polymorphous transformation (L≤10 nm).A term of interface in nanostructure is defined as the area including boundary and close-to-boundary distorted zones. The width of interface has been estimated to be equal of about 1 nm.It has been established that solid-state reactions under severe mechanical treatment begin on condition that α-Fe reaches nanostructural state. The next stage includes penetration of the second component (B, C, Al, Si, Fe, Sn) atoms along grain boundaries of α-Fe and its segregating at boundaries. This segregation is the source to form the first phase in interfaces. Depending on the type of the second component, different phases can be formed: intermetallic compounds, supersaturated solid solutions and amorphous phases.

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