The Phenomenon of Double Diffraction at TEM-identification of Mn-like phases in Fe-based Spinning Ribbons

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The presence of nanostructural stable and/or metastable α- and β-Mn-like phases in high-speed crystallizated Fe-based materials improves useful properties significantly. There are specific peculiarities at identification of Mn-like phases, main causes of which are almost identity of sets of interplanar distances its crystal structures and the phenomenon of double diffraction.

For example, *by the XRD-method* (Fig. 1) the phase composition of $Fe_{75,5}Mo_{10}C_{14,5}$ % at. spinning ribbons (flat molding spinning method, cooling rate ~10^6 K/c, ribbon thickness 30 mkm) is almost *π-phase*: 96π + 4γ.

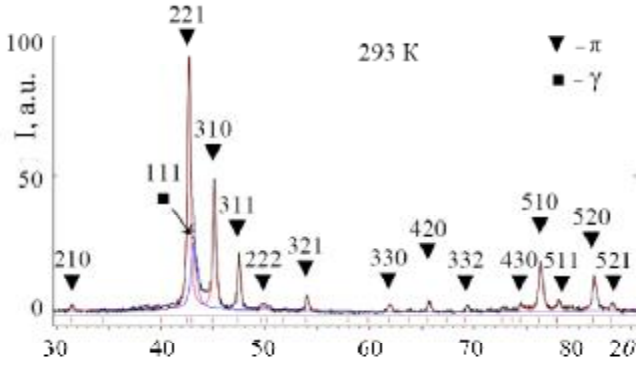

Fig. 1. Rietveld-analysis (Powder Cell 2.4-program) of the XRD-pattern (DRON-UM1, Cu*K*α-radiation, monochromator on diffracted beam) from a powder of $Fe_{75,5}Mo_{10}C_{14,5}$ spinning ribbons: π – β-Mn-like phase, $P4_132$, a=0,6370 nm; γ – fcc-phase, $Fm\bar{3}m$, a=0,3646 nm.

In contradiction to XRD-patterns *by the TEM-method* the phase composition of $Fe_{75,5}Mo_{10}C_{14,5}$ spinning ribbons is almost *χ-phase* (α-Mn-like phase, $I\bar{4}3m$, a_{TEM} ≈ 0,891 nm): χ + γ. This is evidenced by the fact that the most selected areas TEM-diffraction studies found the reflex corresponding to interplanar distance 0,63 nm for α-Mn-like structure only but not for β-Mn-like structure within „fine" grids. However, the angle between the corresponding planes was incorrect. Other a few selected areas TEM-diffraction studies found the reflexes of γ-phase as „large" grid.

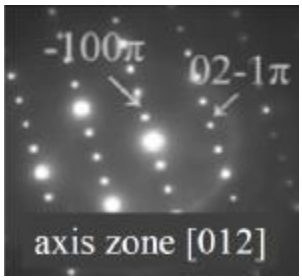

Fig. 2. TEM-pattern of $Fe_{75,5}Mo_{10}C_{14,5}$ spinning ribbon (JEM-100, ion etching, 2,25 nm × мм)

Discovered contradictions may well be explained by phenomenon of double diffraction. Thus, the (100)-type reflexes, prohibited by extinction laws in the β-Mn-type structure appear by the double diffraction from a family of planes {110}π and {111}π, wherein d(100)π ≈ d(110)χ (Fig.2).