Alloy 36NKhTYu is an austenitic precipitation-hardening alloy. Its properties depend on the character of the processes involved in decomposition of the solid solution associated with phase transformations. However, the decomposition of the solid solution, kinetics of the transformation, and the defective structure have not been studied in detail.

This work concerns the structural characteristics of the alloy (0.04% C, 1.1% Mn, 0.36% Si, 36% Ni, 12-13% Cr, 3% Ti, 1.2% Al, the remainder Fe) in relation to the degree of deformation and tempering conditions.

The study was made on band samples 0.15 mm thick. The alloy was quenched in water from 1100°C, rolled with 50-70% reduction, and tempered at 600-750°C for 2 h.

The microstructure was studied by means of the TESLA electron microscope with an accelerating voltage of 80 kV. Positive carbon replicas and thin foils were examined, with x-ray diffraction microscopy.

After quenching from 1100° and rolling, the alloy consists of a homogeneous solid solution with an austenite lattice. Elongated grains with twins that occur during heating at high temperature are visible in
tempering temperature

Fig. 3. Strength of bands of alloy 36KhNBYu in relation to tempering temperature (tempering 2 h) and degree of deformation. (○) \( \varepsilon = 50\% \); (●) \( \varepsilon = 70\% \).

As reported in [1-5], cold plastic deformation changes the mechanical and elastic properties of bands of this alloy. With increasing deformation the ultimate strength, yield strength, elastic limit, and modulus of elasticity increase, and the ductility decreases (Fig. 1). The grains are deformed and the microhardness increases.

The deformed austenite grains are oriented in the rolling direction. High degrees of deformation lead to the development of a large number of dislocations and stacking faults. Dislocation tangles in a single crystal of austenite can be seen in Fig. 2a. Electron diffraction patterns of this section show reflections of homogeneous \( \gamma \) solid solution (austenite). With large deformation of the austenite grains there is partial decomposition of the solid solution and precipitation of finely dispersed phase which, according to x-ray diffraction analysis, is \( \gamma' \) phase of the \((\text{NiFe})_3\text{(TiAl)}\) type with a fcc lattice. Judging from the contrast of the particles (A, Fig. 2b), it is coherently bound to the matrix [6].

Large deformation leads to substantial refining of the structure. Finely dispersed coherent precipitates located at dislocations, in block boundaries, and even in twin boundaries, form a substructure due to strain aging. The existence of the strain aging process in the alloy at \( \varepsilon = 70\% \) makes its structure quite different from that of less deformed alloys. It can be seen in Fig. 1 that strain aging is most evident at \( \varepsilon = 70\% \).

It should be noted that the number of defects increases substantially in samples reduced 70\%. Besides annealing twins that occur during heating at high temperatures, stacking faults appear, overlapping each other and creating microtwins (Fig. 2b).

The substantial changes in structure occurring at high degrees of deformation affect the kinetics of the transformation and consequently the strengthening of the band during subsequent heat treatment. The strength of austenitic alloys increases in the process of tempering. It was reported in [1-3, 7] that decomposition began in samples tempered at 550\°C. At lower tempering temperatures no substantial changes in structure were observed even in electron microscopic analysis. A high degree of cold plastic deformation substantially increases the rate and degree of hardening. This is due to the accelerated decomposition of the microsection. As was reported in [1-5], cold plastic deformation changes the mechanical and elastic properties of bands of this alloy. With increasing deformation the ultimate strength, yield strength, elastic limit, and modulus of elasticity increase, and the ductility decreases (Fig. 1). The grains are deformed and the microhardness increases.

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