Example TEM data analysis

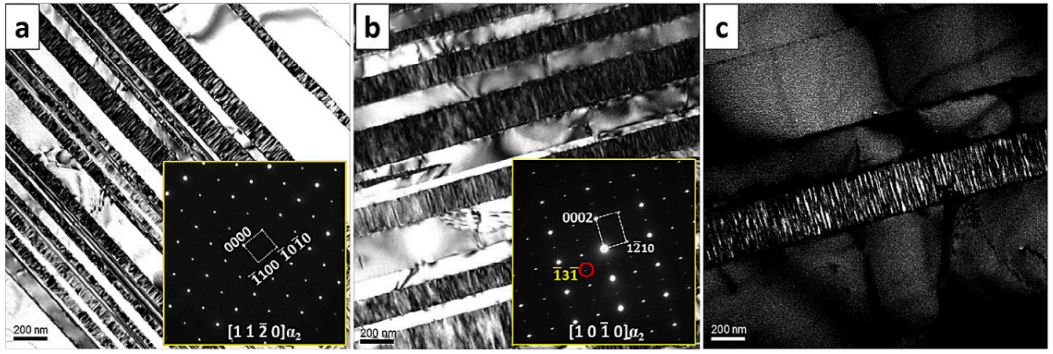
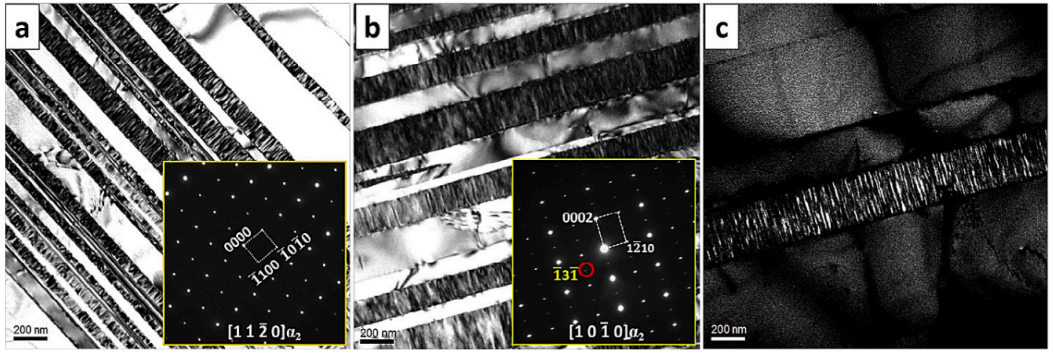


Fig. 2. Bright-field TEM micrographs of modulated α_2 laths with SAED pattern along $<11\bar{2}0>\alpha_2$ (a), along $<10\bar{1}0>\alpha_2$ (b), and dark-field micrograph recorded by a reflection of the O phase indicated by a circle (c).

The microstructure of the γ-based Ti-45Al-8.5Nb alloy observed by SEM in BSE mode is a near fully-lamellar microstructure with an average grain size of 62 μm, as shown in Fig. 1. Lamellar colonies composed of alternating $\alpha_2+\gamma$ laths are arranged randomly. The bright contrast phases often located at the peripheries of the lamellar colonies are the remnant B2 phase [21,22], and the volume faction of remnant B2 phases was estimated to be about 5%.

Fig. 2(a and b) are bright-field TEM micrographs of the microstructure slightly off the $[11\bar{2}0]\alpha_2$ and $[10\bar{1}0]\alpha_2$ directions, respectively, showing a nano-scale modulated structure with tweed contrast within α_2 laths on the γ/α_2 lamellae edge-on projection. The chemical composition analyses were carried out for the γ phase and modulated α_2 laths (ML) in the alloy by EDS, and the results are shown in Table 1. The SAED pattern of the modulated structure along $[11\bar{2}0]\alpha_2$ is inserted in Fig. 2(a), which shows no additional reflections besides those of the α_2 phase. The SAED pattern of the modulated structure along $[10\bar{1}0]\alpha_2$ is inserted in Fig. 2(b), in which the reflections at positions along the $[0001]\alpha_2$ direction extinct for the α_2 phase were observed. These reflections can be indexed as those in the pattern of $[310]_O$ of the O phase, according to orientation relationships of $\{001\}o//\{0001\}\alpha_2$ and $<100>o//<11\bar{2}0>\alpha_2$ reported in the literature [2]. A dark-field TEM micrograph recorded from a reflection of the O phase is shown in Fig. 2(c), indicating a needle-like morphology of the O phase at nano-scale within α_2 laths. The needles of the O phase are vertical to the α_2/γ interface with $\{0001\}\alpha_2//\{111\}\gamma$. One can find that the most of the O phase needles form at the α_2/γ interface and terminate inside the α_2 lath. It is speculated that a mismatch between α_2 and γ phases favors heterogeneous nucleation of the O phase at the α_2/γ interface.

Example TEM data analysis



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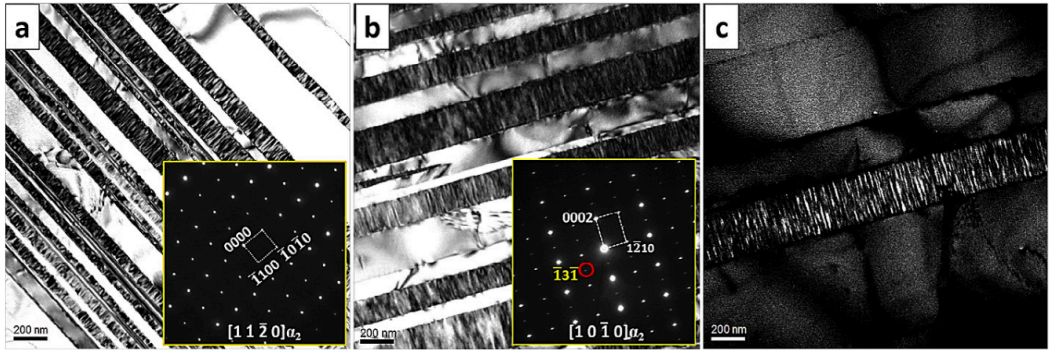
Example TEM data analysis



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Example TEM data analysis