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PII: S1005-0302(17)30124-X
DOI: http://dx.doi.org/doi:10.1016/j.jmst.2017.04.017
Reference: JMST 976

To appear in:

Received date: 4-12-2016
Revised date: 30-12-2016
Accepted date: 9-1-2017

Please cite this article as: Chunbo Lan, Yu Wu, Lili Guo, Huijuan Chen, Feng Chen, Microstructure, texture evolution and mechanical properties of cold rolled Ti-32.5Nb-6.8Zr-2.7Sn biomedical beta titanium alloy (2010), http://dx.doi.org/10.1016/j.jmst.2017.04.017

Microstructure, texture evolution and mechanical properties of cold rolled Ti-32.5Nb-6.8Zr-2.7Sn biomedical beta titanium alloy

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[Received 4 December 2016; received in revised form 30 December 2016; Accepted 9 January 2017]

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Ti-32.5Nb-6.8Zr-2.7Sn (TNZS, wt%) alloy was produced by using vacuum arc melting method, followed by solution treatment and cold rolling with the area reductions of 50% and 90%. The effects of cold rolling on the microstructure, texture evolution and mechanical properties of the experimental alloy were investigated by optical microscopy, X-ray diffraction, transmission electron microscopy and universal material testing machine. The results showed that the grains of the alloy were elongated along rolling direction and stress-induced α" martensite was not detected in the deformed samples. The plastic deformation mechanisms of the alloy were related to {112}⟨111⟩ type deformation twinning and dislocation slipping. Meanwhile, the transition from γ-fiber texture to α-fiber texture took place during cold rolling and a dominant $\{001\}\langle 110\rangle_{\alpha\text{-fiber}}$ texture was obtained after 90% cold deformation. With the increase of cold deformation degree, the strength increased owing to the increase of microstrain, dislocation density and grain refinement, and the elastic modulus decreased owing to the increase of dislocation density as well as an enhanced intensity of $\{001\}\langle 110\rangle_{\alpha\text{-fiber}}$ texture and a