11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Microstructural characterization of β Ti-35Nb alloy after cold rolling

J.F.S.C. Lopes[1*], A.O. F. Hayama[1], R. Caram[1]

(1) DEMA, FEM, Universidade Estadual de Campinas, e-mail: julianalopes@fem.unicamp.br
* Corresponding author.

Abstract – This work describes the main results of microstructural characterization of cold rolled Ti-35Nb alloy. Characterization was performed using light optical microscopy (LOM), X-ray diffraction (XRD) and Vickers hardness measurement. Results show presence of β and α" phases in the samples deformed up to 85% and presence of shear bands in the samples deformed above 52%.

Titanium and its alloys are materials used as biomaterials and exhibit the most suitable characteristics for biomedical applications as high biocompatibility, high mechanical strength and good corrosion resistence.[1] Titanium alloys applied as orthopedic biomaterials should present low Young´s modulus, as close as possible to that of human bones and also present nontoxic elements in its composition, like Nb, Ta and Zr. When compared with other Ti alloys, β type alloys show lower Young´s modulus.[2]

This work presents the main results of microstructural characterization of cold rolled Ti-35Nb alloy. Starting materials were obtained by means of arc melting, followed by solution heat treatment, resulting in a microstructure composed by β phase and orthorhombic martensite (α") phase. Orthorhombic martensite is a metastable phase formed during quenching (athermal martensite) or can also be formed on application of external forces (stress induced martensite). After solution treatment, samples were cold rolled up to 85% of reduction.

Results show the presence of β phase and α" in the samples deformed up to 85% (Figure 1). Samples cold rolled up to 52% present occurrence of orientation of martensite phase in relation to the rolling direction. Samples with higher deformation, above 52% of deformation, present deformation heterogeneity (shear bands) (Figure 2).

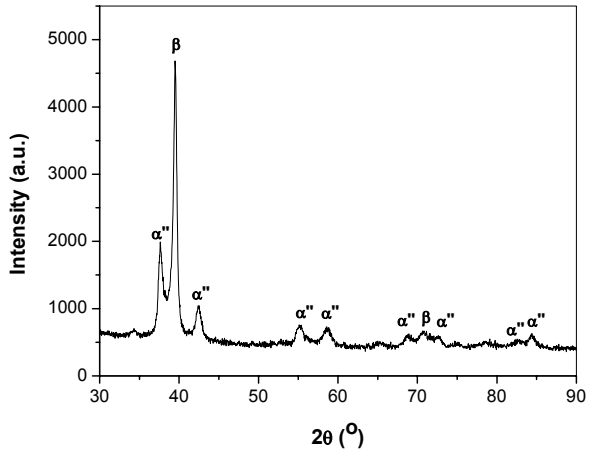

Figure 1: X-ray diffractogram of Ti-35Nb alloy cold rolled up to 85%.

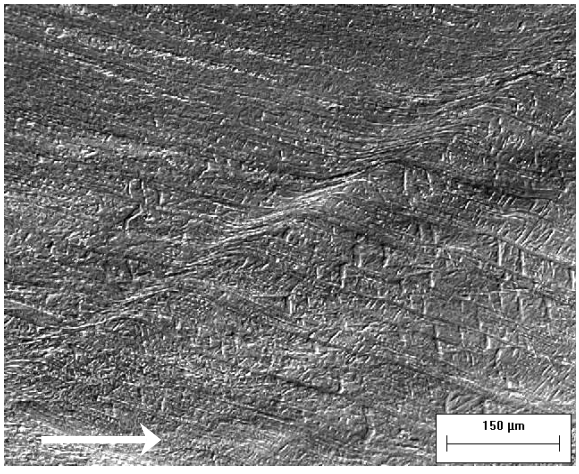

Figure 2: Micrograph of Ti-35Nb alloy cold rolled up to 52% showing the presence of a shear band (LOM, Nomarski contrast). The arrow indicates the rolling direction.

References

[1] M. Niinomi, Journal of the Mechanical Behavior of Biomedical Materials 1, 30 (2008).
[2] M. Niinomi, Mater. Sci. Eng. 243, 232 (1998).