In-Situ Characterization of Ti-25Nb-4Sn Alloy through Synchrotron Radiation

G.T. Aleixo¹, A. Cremasco¹, E.S.N. Lopes¹ and R. Caram¹

¹ School of Mechanical Engineering, University of Campinas, Campinas – SP – Brazil

Heat treatment of β-Ti alloys plays an important role in determining microstructure and properties according to composition of β stabilizing elements⁴. The aim of this work was to study in-situ aging of water quenched Ti-25Nb-4Sn alloys by means of X-ray diffraction (XRD) using synchrotron radiation. Ti-25Nb-4Sn was prepared from high purity Ti sheets (99.84%), Nb (99.99%), Sn (99.95%), according to their nominal composition in an arc-melting furnace under vacuum and inert atmosphere with argon gas and submitted to homogenization heat treatment at 1000ºC/8h and then furnace cooled. Following, sample was submitted to swaging at 780-860ºC producing a final 11 mm diameter rod and machined as a cylinder of 10.5 mm Ø x 100 mm length. Cylindrical sample was submitted to solution treatment in β field (1000ºC/1h) and then water quenched. Sample of water quenched Ti-25Nb-4Sn alloy was aged and characterized by using synchrotron radiation with λ= 1.54 Å.

Fig. 1 presents X-ray diffractograms using synchrotron radiation of the quenched Ti-25Nb-4Sn alloy sample obtained during the aging process. A 1ˢᵗ DXR profile that was obtained at room temperature indicates α” presence. After 3 min. at 180ºC, the 2ⁿᵈ scan was performed. Both analyses indicated the presence of α”. After 4.5h at 180ºC, sample was heated to 400ºC and the 3ʳᵈ scan was obtained after 15 min. XRD patterns shows decomposition of α” and the nucleation and growth of the β and α. The formation process of α and β phases involves reverse transformation of martensite (α”→β) and possible precipitation of ω, which dissolves during the formation of α. Following, the sample was heat up to 500ºC and after 20 min, a new XRD analysis was carried out and the results show the precipitation of α. Subsequently, the sample was furnace cooled to room temperature. The main aim of these experiments was to observe α” decomposition, specifically, α”→β, β→ω and ω→α. It shows evidences of ω precipitation in the martensitic α” matrix. As the temperature was increased, it was noted that decomposition of orthorhombic α” phase takes place, forming β, probably ω and finally, α. The α nucleation was facilitated due to the presence of ω precipitates.

Figure 1.
XRD patterns obtained of quenched Ti-25Nb-4Sn.


giorgia@fem.unicamp.br; Dema/Fem/Unicamp – CP: 6122 – CEP: 13083-500.