

Phase Analysis of Ti-Ta-Nb Alloy Surface by Micro-XRD

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1. Introduction

Ternary titanium alloys have focused on biocompatibility and improved the mechanical property for dental and biomedical applications. Properties of these alloys depend on their microstructural phases. Micro-XRD methods were used for determination of the phases at the point of specimens. In this study, phase of Ti-Ta-Nb alloy were identified by Micro-XRD.

2. Materials and Method

Ti-Ta-Nb, Ti-Ta-Zr, Ti-Nb-Ta and Ti-Nb-Zr alloys were prepared by arc melting and homogenized for 24 hr at 1000°C in an argon atmosphere. Micro-XRD was performed at several points on each specimen and more points for specimens with substantial compositional variation. For conventional XRD (Rint-2000, Rigaku), CuK radiation was employed at 40kV and tube current of 100 mA. For Micro-XRD (Rint-2000), the tube current was 300 mA. The diameter of each MicroXRD analysis site was approximately 100 μ m.

3. Results

For Ti-Ta-Zr, all spectra had major peaks for alpha-titanium with some peaks for beta-titanium. For Ti-Nb-Zr, all spectra had major peaks for beta-titanium, and only Ti-Nb-7Zr showed 101 and 102 peaks for alpha-titanium. For Ti-Nb-Ta, most peaks were assigned to beta-titanium, but Ti-Nb-3Ta and Ti-Nb-7Ta also had peaks for alpha-titanium. Micro-XRD analyses were generally consistent with conventional XRD from larger regions of approximately 1 cm diameter. XRD showed that all peaks for Ti-Ta-3Nb and Ti-Ta-7Nb were for alpha-titanium, but Ti-Ta-10Nb had the 211 peak for beta-titanium and Ti-Ta-15Nb had four major peaks (110, 200, 211 and 310) for beta-titanium.

It was confirmed that Micro-XRD can be used for identification of dental alloy with variation of specimen position.