CHAPTER 6 CONCLUSIONS

The following conclusions can be drawn from this study;

1. Local raw materials can be successfully used to synthesize titanium aluminides with the compositions Ti-46Al, Ti-48Al, Ti-46Al-5Nb, Ti-48Al-5Nb, Ti-46Al-10Nb, Ti-48Al-10Nb, Ti-46Al-2Mo, Ti-46Al-2Cr, Ti-46Al-4Nb-2Mo, and Ti-46Al-4Nb-2Cr.
2. The structure of as-cast samples consists primarily of γ-TiAl with small fractions of the α_2-Ti_3Al. Lamellar structures with some equiaxed structures were found in all binary and ternary alloys. Additions of Nb in binary Ti-46Al and Ti-48Al alloys effectively decreased lamellar grain size.
3. Low-Al content with Nb addition alloys with fully lamellar microstructures has the highest microhardness values.
4. The presence of Mo in Ti-Al-Nb alloys increase the quantity of β phase for solution treatment, furnace and air cooling and helps stabilize the lamellar structures. Nb, Mo, and Cr additions can promote the formation of fully lamellar and duplex structure. Additions of Mo and Nb also decrease the colony size of the duplex structure.
5. EBSD study revealed that the additions of Nb, Mo and Cr affects the γ-massive transformation as well as the structure and orientation of the phase which is related to the parent phase according to the Blackburn-orientation relationship: $(0001)_{\alpha 2} \| \{111\}_{\gamma}$ and $\langle 11\bar{2}0\rangle_{\alpha 2} \left\| \langle 1\bar{1}0]_{\gamma}\right.$.
6. The structure of solution treatment for Ti-46Al-2Mo, Ti-46Al-2Cr, Ti-46Al-4Nb-2Mo, and Ti-46Al-4Nb-2Cr alloys consisted of two phase γ+ α_2 lamellae and a small equiaxed microstructure of β phase.

7. Cooling rates, particularly slow and intermediate cooling rates such as those achieved with either furnace or air cooling, have a significant effect on the resulting structure. Fully lamellar, Widmanstätten laths, and feathery-like structures transformation were observed in these cooling regime.
8. Rapid cooling, achieved by oil and water quenching, results in an increase in the γ-massive transformation. Nb addition also promotes the massive transformation process. In ternary alloys containing Cr, the α_2-massive transformation occurs when cooled in oil.
9. Microhardness values of massive structure were found to be higher than those of lamellar structures.

The research results can be summarized as follows. The practice to obtain refined convoluted structure through massive transform of the γ-massive structure, providing high specific strength at elevated temperatures, can be done by Nb addition and rapid cooling in media, such as oil and water. The practice to obtain β-phase for promoting ductility and good machinability of titanium aluminides at room temperature can be done by Mo addition and slow cooling.