

**UNIVERSITI TEKNOLOGI MARA**

**FABRICATION OF POROUS TiNb  
ALLOY INCORPORATED WITH  
TiH<sub>2</sub> POWDER BY POWDER  
METALLURGY PROCESSING  
ROUTE FOR IMPLANT  
APPLICATIONS**

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## ABSTRACT

In the development of implant material, TiNb alloy has become a great interest due to promising mechanical properties that mimic human bone. The promising mechanical properties were due to the present of the  $\beta$ -rich phase in the alloy. Since concern was raised toward the high manufacturing cost, the present study introduced a new approach of using  $\text{TiH}_2$  powder, which is cheaper as a reactant instead of Ti powder that is normally employed to fabricate TiNb alloy. In the present study, TiNb alloy had been successfully fabricated via powder metallurgy (PM) processing route under argon environment. The TiNb alloy was fabricated to a composition of 10, 25, 40 and 45 (weight%) of Nb. The powder mixtures with relative composition were subjected to milling, compaction, cold isostatic pressing (CIP), and sintering processes. Besides the influence composition of alloy on the microstructure and mechanical properties, the present work also studied the influence of embedded agent ( $\text{CaH}_2$  and  $\text{Y}_2\text{O}_3$  powders) specifically on helping to reduce the impurities uptake by the alloy during the sintering process. From the result, it was found that different composition of Nb, as well as a different embedded agent, resulted in several  $\beta$ -phase constituent and porosity of TiNb alloy. The combination of  $\beta$ -rich phase and porosity consequently resulted in mechanical properties with the Young's modulus satisfying the requirement for a bone implant. There is a trend established from the study that increased the Nb composition in the alloy, while the  $\beta$ -phase and porosity attained were increased and the Young's modulus was decreased, respectively.

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