SUMMER RESEARCH 2024/25
PROJECT ABSTRACT

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

PROJECT # 38

SUPERVISOR/S: Dr. Ajit Pal Singh

PROJECT TITLE: Study of Phase Transformation in Titanium Alloys

FIELD: Materials and Process Engineering

DIVISION/SCHOOL: HECS - Te Kura Mata Ao School of Engineering

PROJECT LOCATION: Hamilton

PROJECT ABSTRACT:

Titanium alloys, known for their exceptional mechanical properties, corrosion resistance, and biocompatibility, are extensively utilised in aerospace, marine, and biomedical applications. Among these alloys, Ti–6Al–4V stands out due to its dual-phase nature, transitioning from the alpha phase to the beta phase until it reaches the critical beta-transus temperature at 980°C. The presence of oxygen as an interstitial impurity element plays a pivotal role in shaping the microstructure and mechanical characteristics of Ti-6Al-4V. Oxygen serves as an alpha stabiliser, influencing the beta-transus temperature, and even slight variations in oxygen content can significantly impact the essential Alpha to Beta transformation. Understanding the correlation between beta-transus temperature and oxygen content is crucial for precisely controlling the alloy's microstructure and mechanical properties during manufacturing.

STUDENT SKILLS:

- Must have fundamental knowledge of metallic materials and mechanical properties.
- Basic knowledge of metallographic sample preparation techniques would be desirable.
- Prior tensile testing experience would be beneficial.
- Proven record of solving challenging engineering problems through project-based learning
- Must have good time/project management skills to track the progress.
- Excellent written and verbal skills.
- Offer high work ethic, adjustable nature, and experience of adapting own skills to new circumstances

PROJECT TASKS:

1. Determine beta-transus temperatures through detailed analysis using a Differential Scanning Calorimeter (DSC).
2. Confirm and validate the DSC findings through additional experiments utilising the metallographic method.
3. Comprehensively understand the influence of impurity oxygen on the beta-transus temperature in Ti-6Al-4V alloy.
4. Investigate the subsequent changes in microstructure during the alpha-to-beta transformation.
5. Prepare mechanical test specimens and perform tests in accordance with appropriate international standards.
6. Write a technical report and showcase the research by developing a poster

EXPECTED OUTCOMES:

- Student's Research Poster (as per clause 6 of the Scholarship regulations)
- The student will gain an understanding of process-structure-property relationships.
- The collection of pilot data will assist with future funding proposals