

Welding Characteristics of Titanium Alloys with Interlayers

SP700 Base Metal with Ti 1023 Interlayer

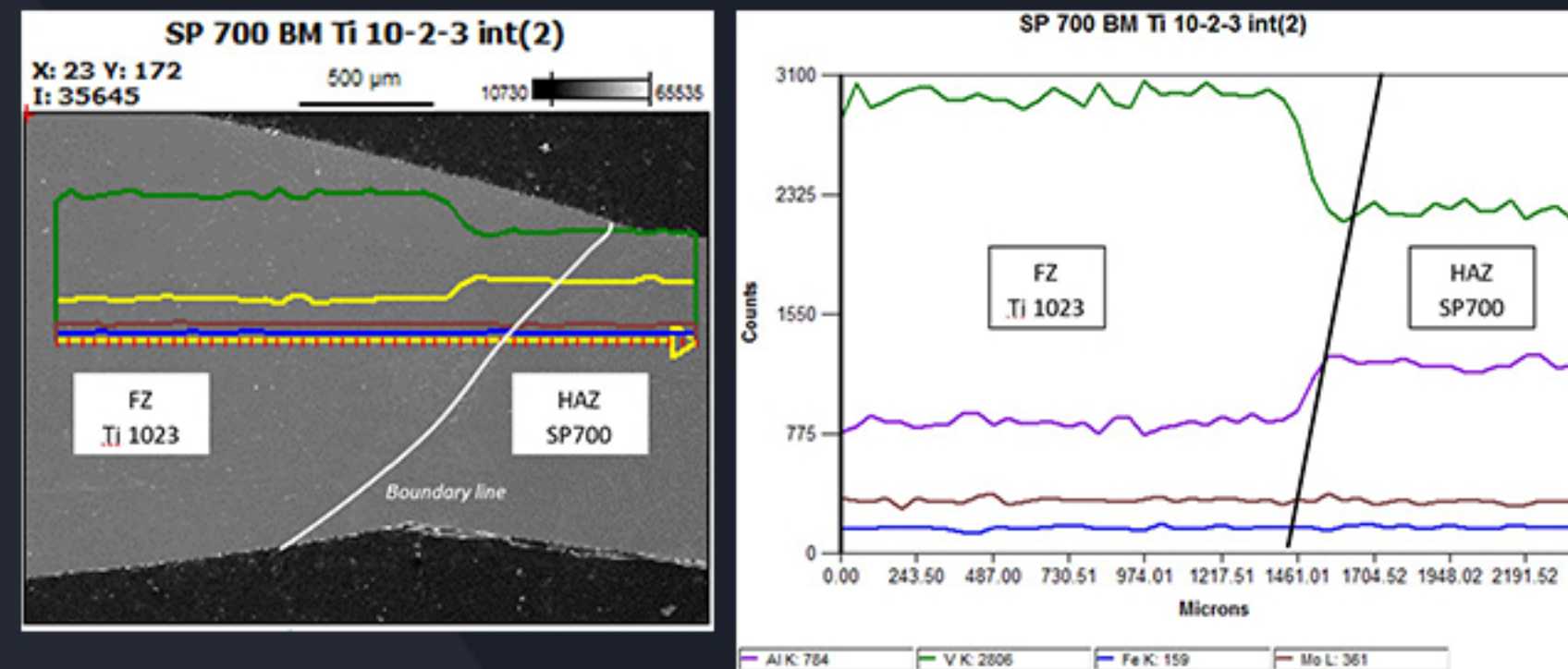
Titanium has a high strength to weight ratio and is popular with the aerospace industry.

Titanium can be manufactured with various amounts of α -content and β -content. Alloys manufactured with an evenly distributed ratio of α -content to β -content forms α - β alloys, while having alloys that have a significantly more β -content are referred to as metastable- β alloys.

The two alloys analysed were the α - β SP700 (Ti-4.5Al-3V-2Fe-2Mo) and the metastable- β Ti 1023 (Ti-10V-2Fe-3Al). These two types of alloys are welded together using a GTAW rig, where SP700 was used as the base metal (BM), and Ti 1023 was used as the interlayer. The welded samples were cut into dogbones & coupons and then analysed using various mechanical tests.

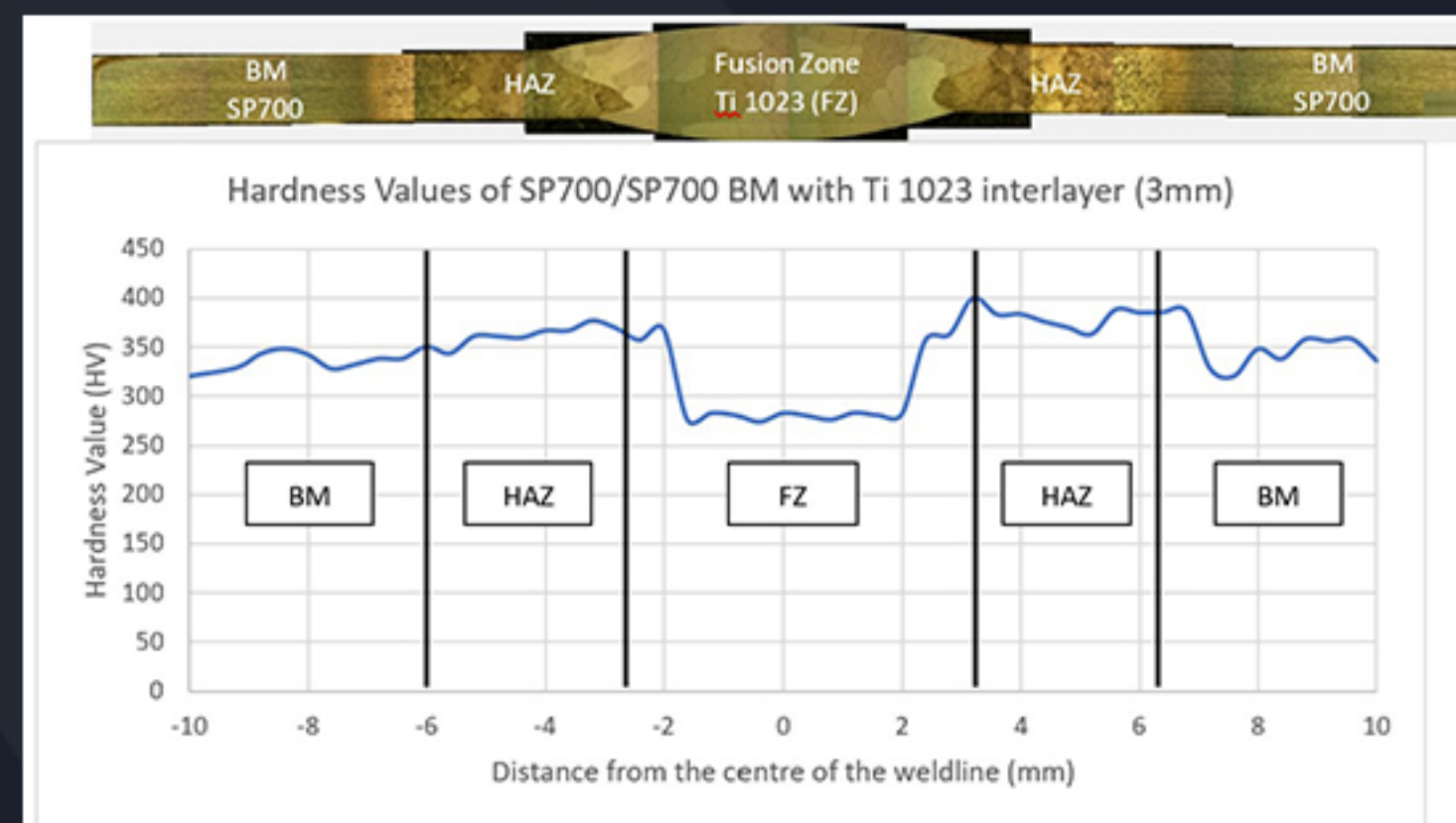
These findings were presented during the tech exchange event between AUT & AIM-HI on August 31st, 2020.

SAMPLE SETUP



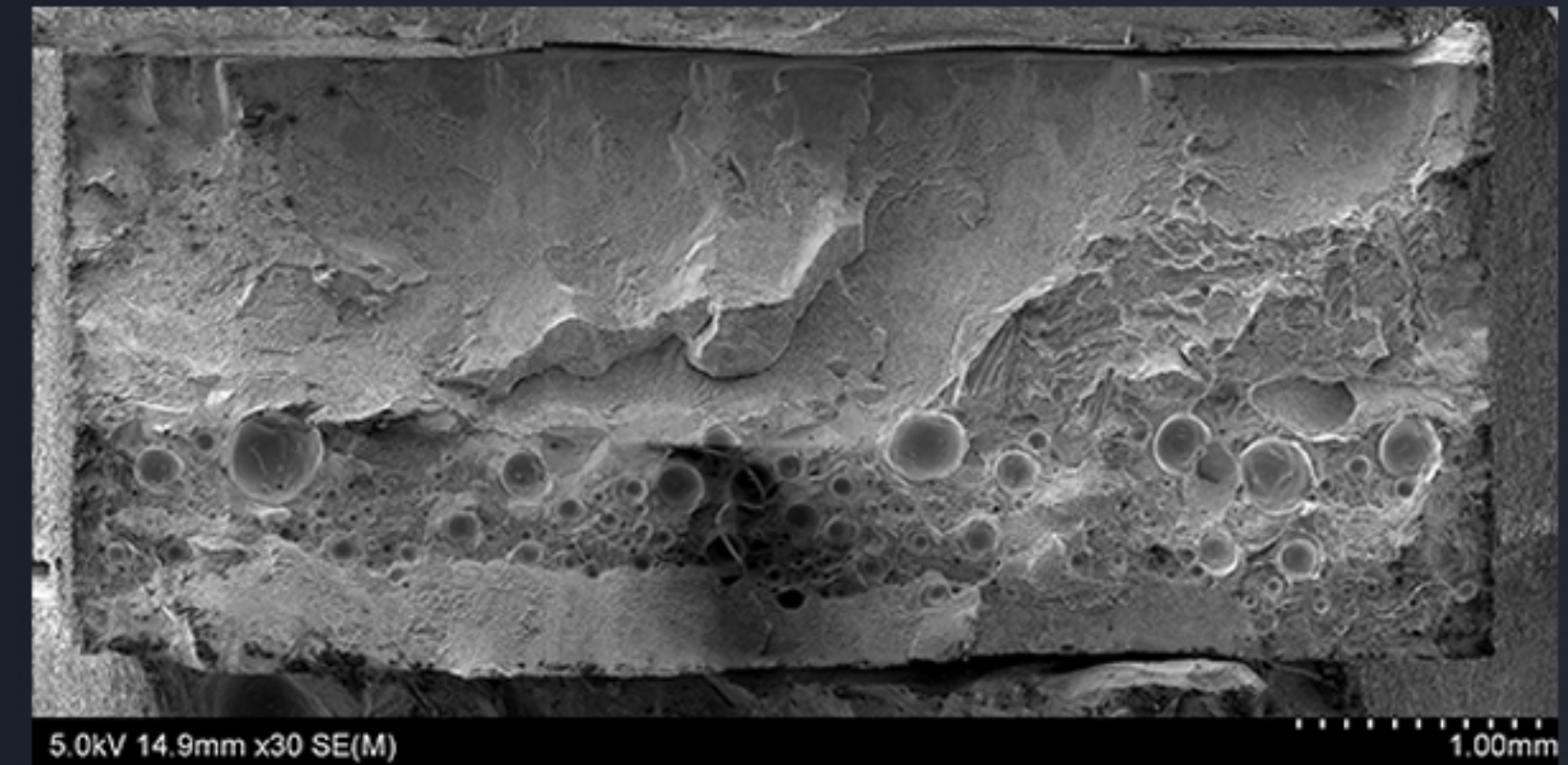
LINE ANALYSIS

Depicts β -stability of alloys: High β -content in FZ (Ti 1023), Low β -content in HAZ (SP700)



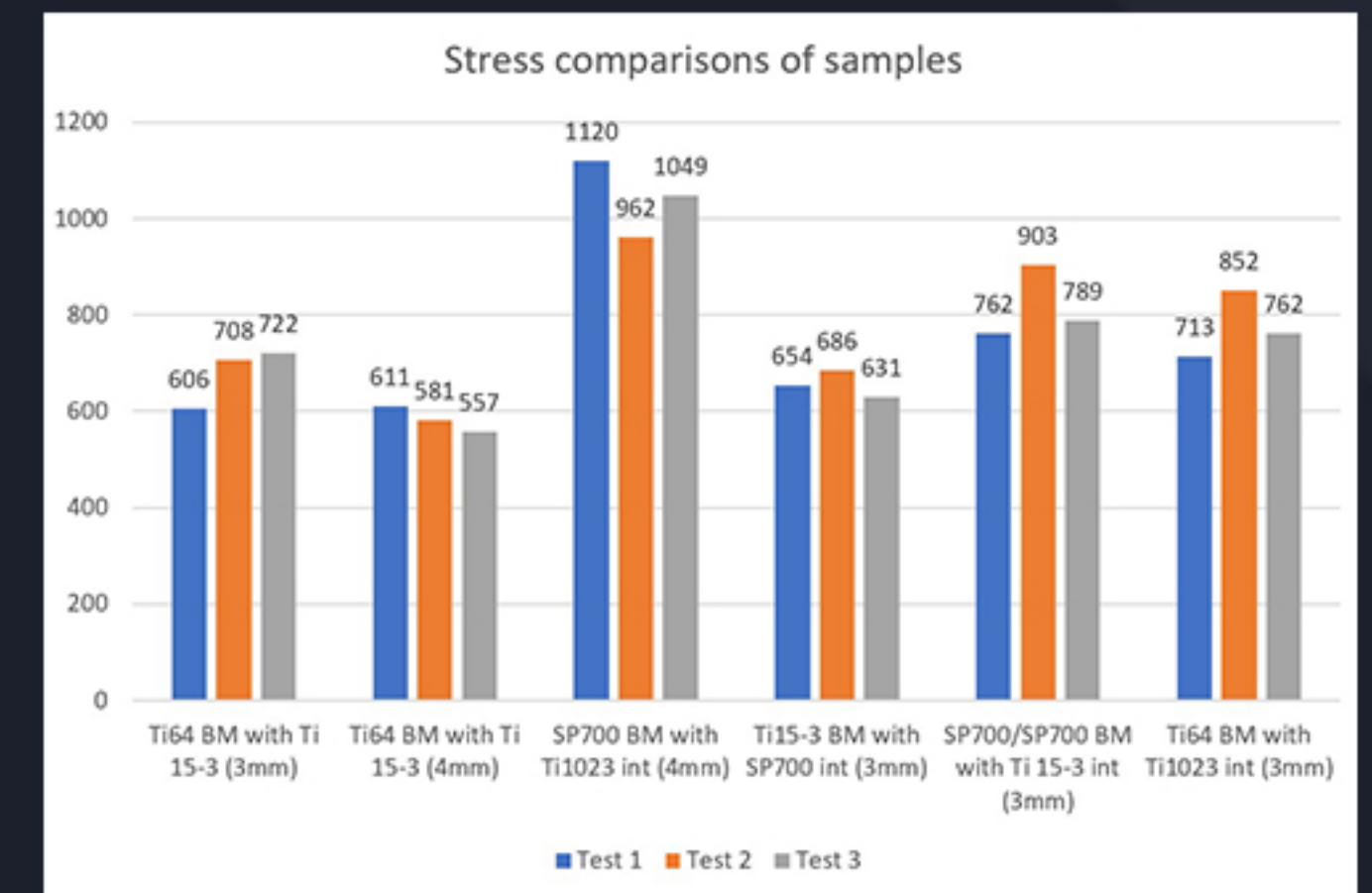
HARDNESS PROFILE

- Hardness in BM and HAZ were similar between 336.1-363.1 HV but dropped in the FZ around 280 HV.
- β -content is still too prominent, leading to a softer welded sample.
- Reducing the length of the interlayer may produce a consistent hardness throughout the weldment.



MACROGRAPH OF FRACTURE SURFACE

- Fibrous patterns with dimples
- Material stretched before failure, indicates ductile fracture.
- Tiny voids combine into a larger fracture and initiates failure.



TENSILE TESTED SAMPLES

My samples had an average tensile strength of 1044 MPa.

- Precipitation hardening
- Restrict dislocation movement and increases its strength levels.
- β -alloys also have BCC structure, more slips systems for deformation to occur