

Material Properties Evaluation of a Hot Isostatically Pressed Tantalum Pressure Vessel for the ISIS TS-2 Target

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Computer aided engineering analysis requires sound mechanical properties data to be effective. High quality data for Hot Isostatically Pressed (HIP) Tantalum was not available so a series of tests were conducted to establish the in service properties of a pressure vessel assembly manufactured from materials made by this route.

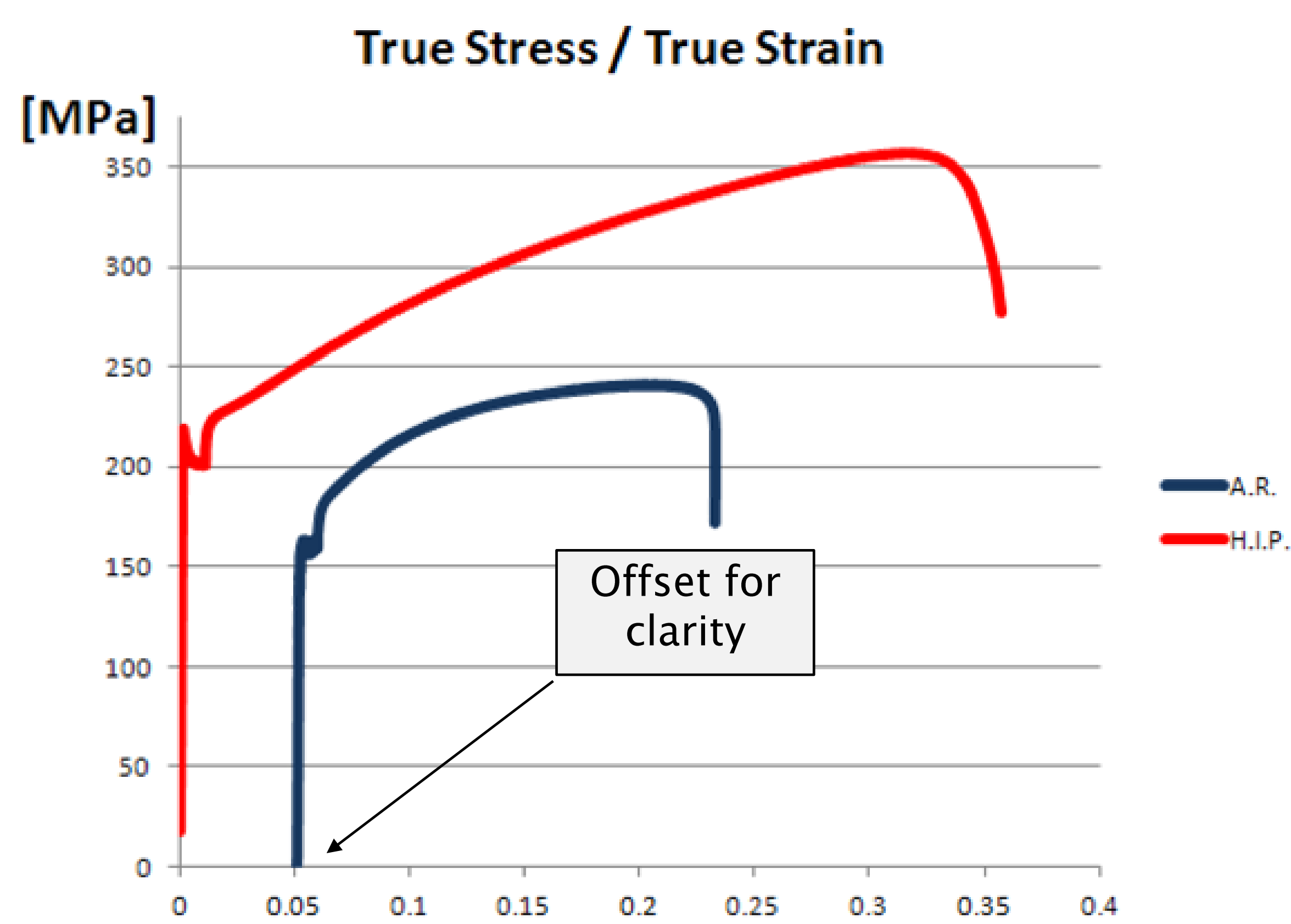
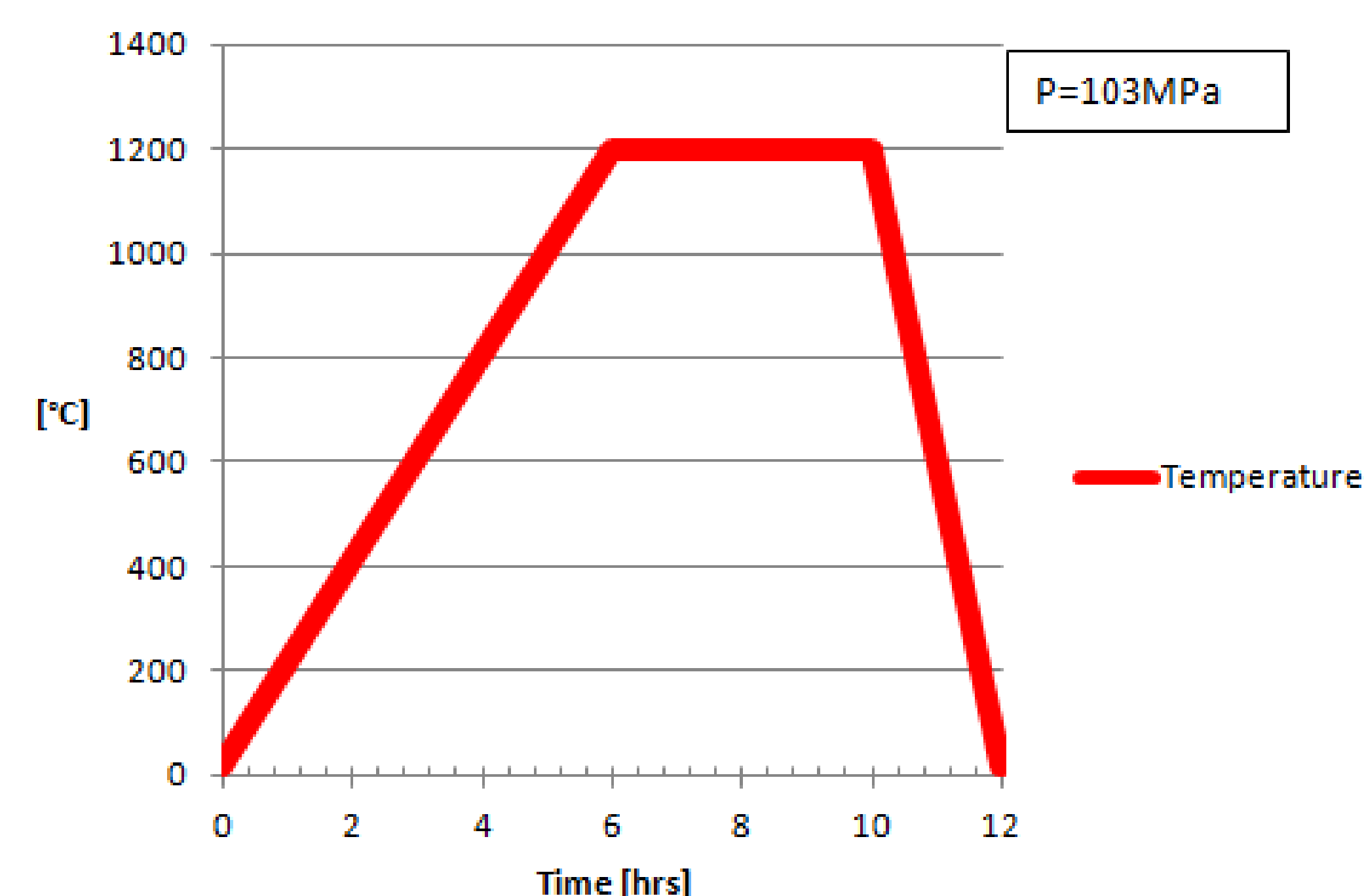
Tube Tensile Test Results.

CONDITION	ID	0.2%PS [MPa]	UTS [MPa]	E [GPa]
A.R.	71485	194	238	
	71486	194	239	208.6
	71487	161	212	208.8
	Mean	183.0	229.7	208.7
	SD	19.05	15.31	0.17
H.I.P.				
	70779	207	268	173.1
	70780	187	270	171.5
	70781	186	264	171.4
	Mean	193.3	267.3	172.0
	SD	11.85	3.06	0.94



A Completed ISIS TS2 Target Awaiting Final Inspection.

HIP Temperature Profile



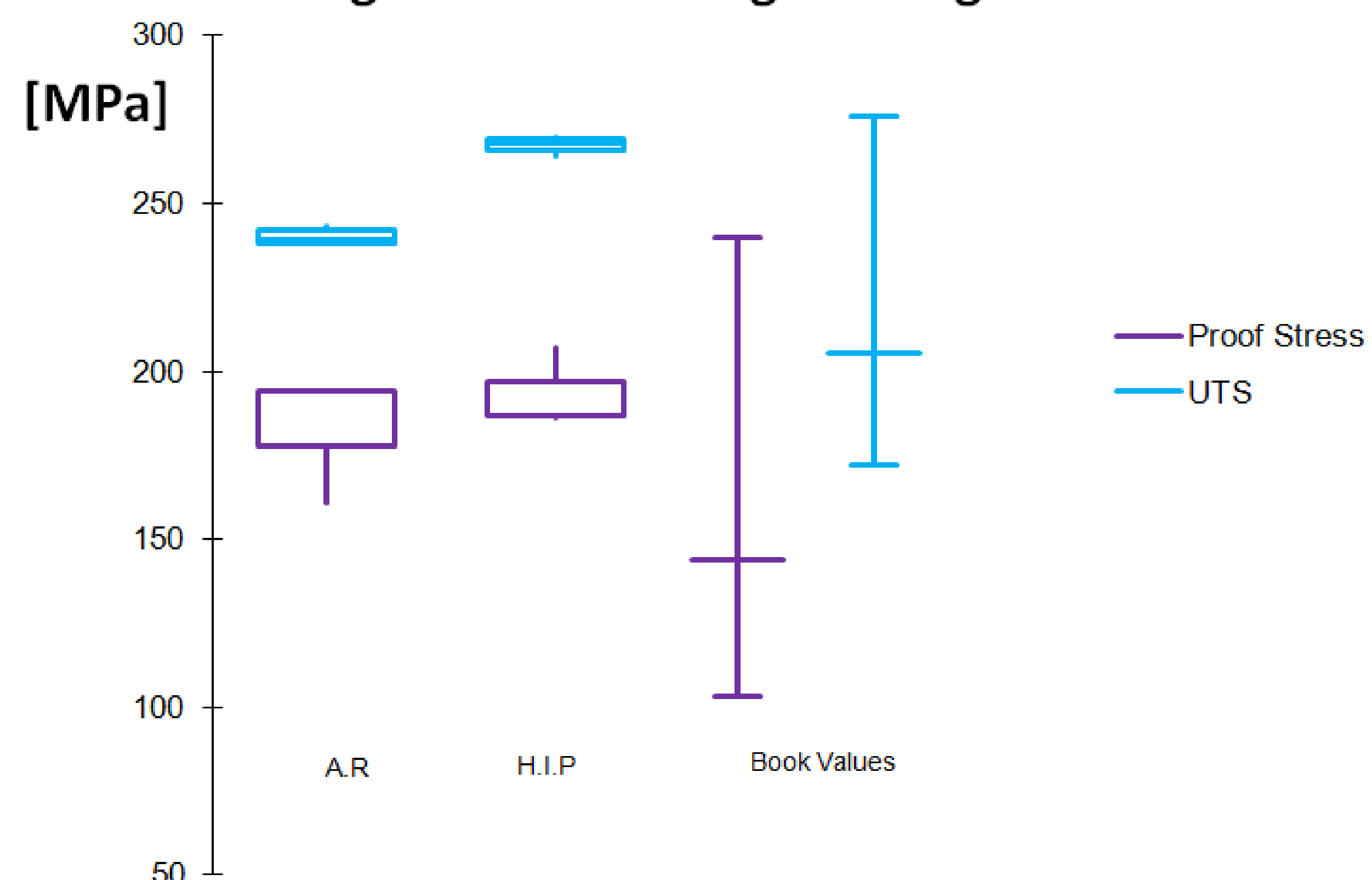
Tensile Test Based on ASTM E8M

Conclusions

On the Tantalum sample tested the HIP process effected both UTS and Elastic Modulus. Increasing the measured UTS by approximately 16% and reducing the Elastic Modulus by a similar amount at room temperature.

The values found fell within the range of published data, all being toward the higher end.

Range of Values - Engineering Stress



Further Work

Material properties at elevated temperatures would be useful for future Target designs and so should be measured.

In this testing only a tube offcut was available for testing. Due to the sample size it was not possible to measure Poisson's ratio. It would be useful to measure this in any further work.