Laboratory Journal

Mecanon/COPPE

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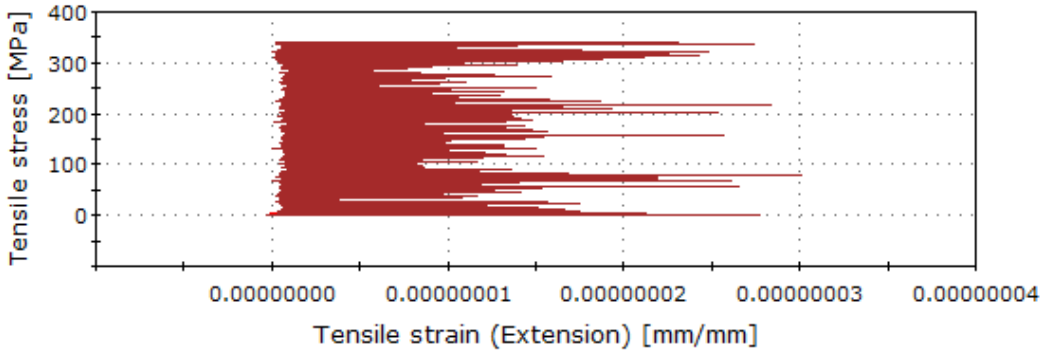
Contents

Wednesday, 22 June 2016

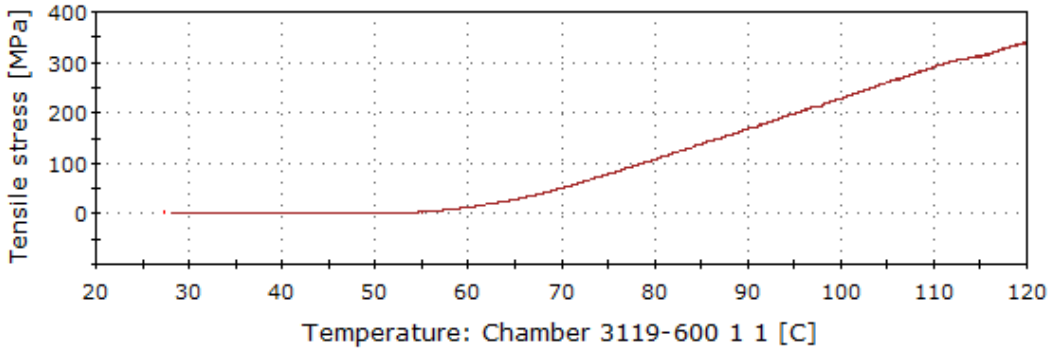
1 Instron: Constant strain under heating

File: dynalloy constant strain
Objective: Is there recoverable strain at zero stress?
Test to verify if the are any recoverable deformation at zero stress. The wire is originally loose, hence not tensioned, and was pre-heated to avoida any transformation strain.



Graph 2

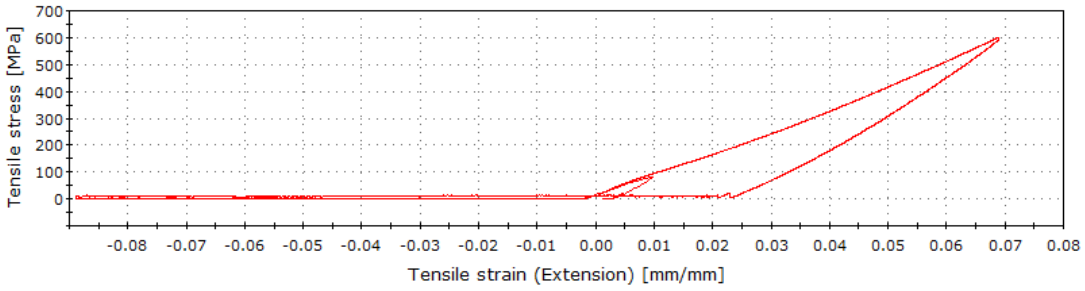
Specimen 1 to 2



Conclusion: Since the stress increases when the wire is heated, there is contraction even in free-stress conditions.

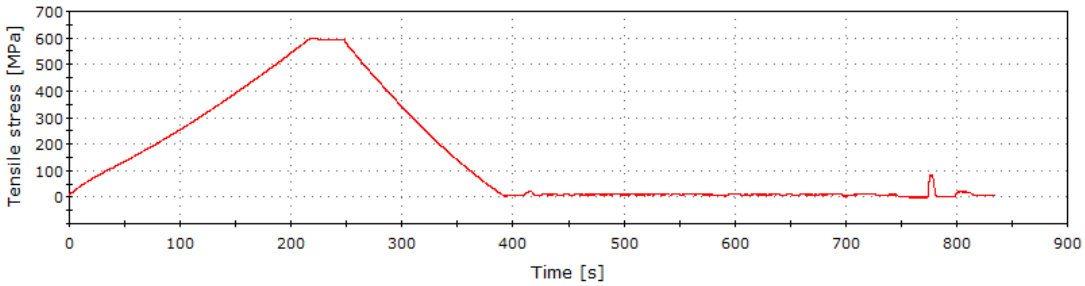
2 Instron: Shape memory effect

File: dynalloy hybrid SME
Objective: Evaluate for 600MPa if the shape memory effect takes place
The wire was pre-heated to avoid any previous detwinning. From previous tensile tests, it seems that 600/700 MPa is the detwinning stress; hence the wire is loaded up to 600 MPa and unloaded. There will be residual strain. Afterwards the wire is heated above all transformation temperatures. When heating was necessary, the chamber door was closed and the SMA wire was heated. When closing the door, the tensile stress is slightly effected; hence, the experiment should start opened or only be closed when stress is equal to zero. Cooling is undertaken via free convection by opening the chamber door. However, such cooling is quite fast and the Instron stress controller has difficulty stabilizing it.



Graph 2

Specimen 1 to 1



Conclusion: There is a residual strain after loading up to 600 MPa. When heating the SMA shrinks to a length smaller than its original length. This indicates that the wire is *two-way* material. (Lagoudas book, section 1.6 [1])

Thursday, 23 June 2016

1 Current Sensor: Calibration and first results of measurement.

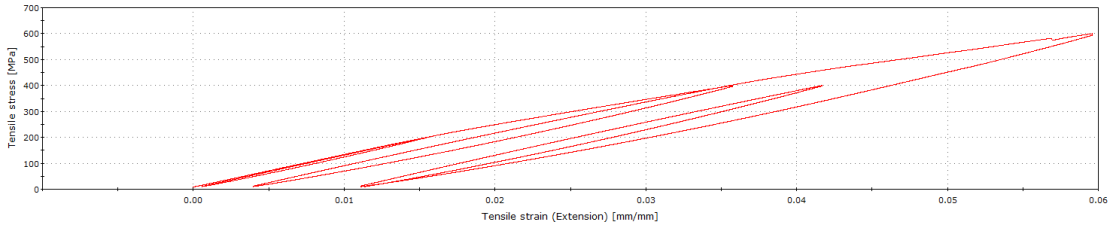
File: Current Sensor: Calibration. ???(IS THIS THE NAME OF THE FILE STORING THE DATA?!)
Objective: Are the sensor measurements reliable?
Procedure for sensor calibration:

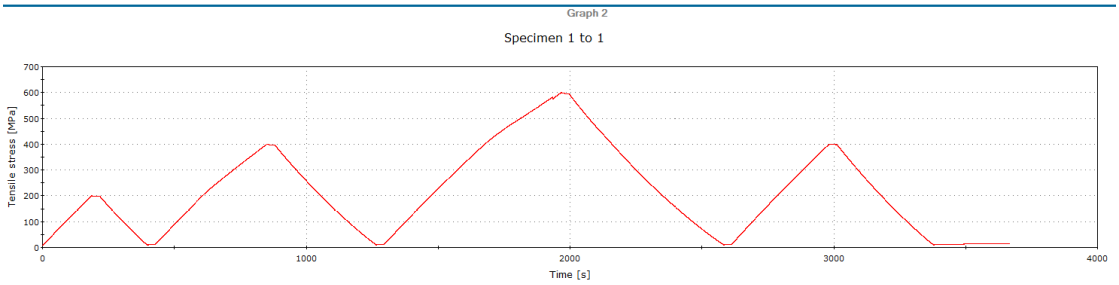
- *First Step*: Calibrate the output offset, with zero current on the sense lines(???), using the V_{ref} trimpot. (WHAT IS A TRIMPOT?)
- *Second Step*: Using a known current, adjust the GAIN trimpot until the measured current showed in the monitor serial is similar to the current showed in the reference sensor.

Conclusion:

2 Instron: Cyclic loading (200MPa,400MPa, 600MPa, 400MPa) at room temperature.

Objective: Verify influence of residual strain **File:** DYN1 cyclic loading T0

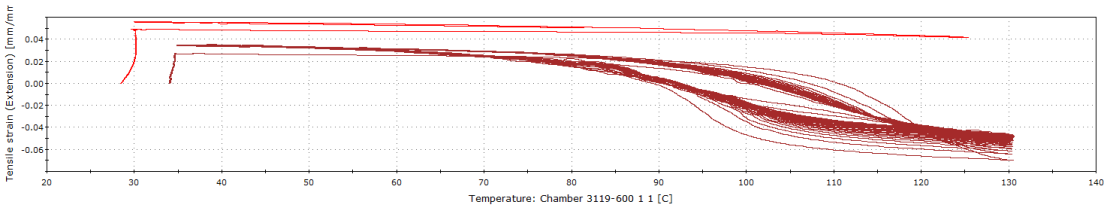


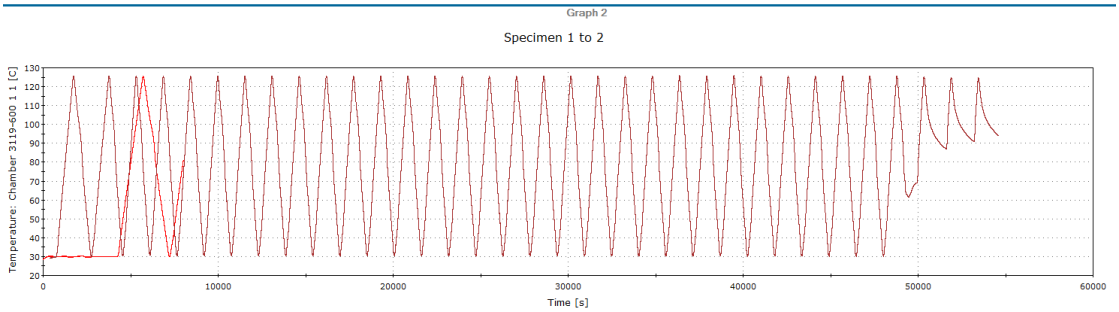


Friday, 24 June 2016

1 Instron: Training - Cyclic heating at 200MPa.

File: DYN1 cyclic temperature 200MPa
Objective: Train SMA wire
Previous training at 172 MPa did not stabilize SMA for other stresses. Thermal cycling at 600 MPa.





Conclusion: With the current parameters, 30 cycles were successfully undertaken at 20MPa. The final cycles did not cool down because of lack of liquid nitrogen.

Friday, 24 June 2016

1 Instron: Thermal cycling at constant stress (50MPa, 100MPa, 150MPa, 172MPa).

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Formulae and Media Recipes

Media

Media 1

Compound	1L	0.5L
Compound 1	10g	5g
Compound 2	20g	10g

Table 1: Ingredients in Media 1.

Formulae

Formula 1 - Pythagorean theorem

$a^2 + b^2 = c^2$

Bibliography

[1] D. Lagoudas, *Shape memory alloys: modeling and engineering applications*. New York: Springer, 1st ed ed., 2008. 2