Tension-Torsion Tests

Measured variables:

Time [s] – Measurement time

Angular Dis. [rad/mm] – Wire angular displacement per unit length

Torque [N.mm] – Torque corresponding to the actual wire angular displacement

Ax.Stroke [mm] – Axial stroke

Strain [%] – Axial strain (engineering)

Ax. Force [N] – Applied axial force F

Stress [MPa] – Applied axial stress (σ=F/A´), A´- actual wire cross section (constant wire volume assumed)

Resis [Ohm] – Electrical resistance

El.Res. [Ohm.µm] – Electrical resistivity

Temp [°C] – Wire temperature controlled by Peltier furnace

Ls0 [mm] – initial wire length

ds0 [mm] – initial wire diameter

Dataset file labelling for Torsion Tests

Torsion Tests – Wire is twisted under constant axial stress at a defined temperature

Examples:

000_TT_AxLoad_70MPa_Temp_50C.att

100_TT_AxLoad_70MPa_TempSetUp_50C.att

200_TT_AxLoad_70MPa_Temp_50C_Training.att

Numbers related to files containing:

000-099 –regular measurement data

100-199 –data of high temperature Austenite reset and temperature setting prior to the regular test

200-299 –data of the wire training prior to temperature setting

TT – Torsion Test

AxLoad_70MPa – Applied wire axial stress realized by constant mass hanged on the wire

Temp_50C – Measured temperature for Torque-Angular displacement wire response

TempSetUp_50C - High temperature Austenite reset 120°C, Measuring Temperature Setup

Training – Wire training before test (10 symmetrical torque cycles at temperature 50°C)

Dataset file labelling for Constant Torque Tests

Constant Torque Tests – Wire temperature is changed upon constant axial stress and defined torque

Examples:

005_CTT_AxLoad_70MPa_Torque_0.044Nmm.att

200_CTT_AxLoad_70MPa_Temp_50C_Training.att

Numbers related to files containing:

000-099 – regular measurement data

200-299 – data of the wire training prior to the regular test

CTT – Constant Torque Test

AxLoad_70MPa – Applied wire axial stress realized by constant mass hanged on the wire

Torque_0.044Nmm – Applied constant Torque before temperature cycling (-50°C – 120°C)

Training – Wire training before test (10 symmetrical torque cycles at temperature 50°C)

Tension Tests

Measured variables:

time [s] – Measurement time

temperature [°C] – Wire temperature controlled by Peltier furnace

stroke [mm] – Axial stroke

load [N] – Applied axial force F

strain [%] – Axial strain (engineering)

stress [MPa] – Axial stress (engineering)

initial diameter [mm] – initial wire diameter

initial length [mm] – initial wire length

el. resistance [Ohm] – Electrical resistance

resistivity [Ohm.mm] – Electrical resistivity

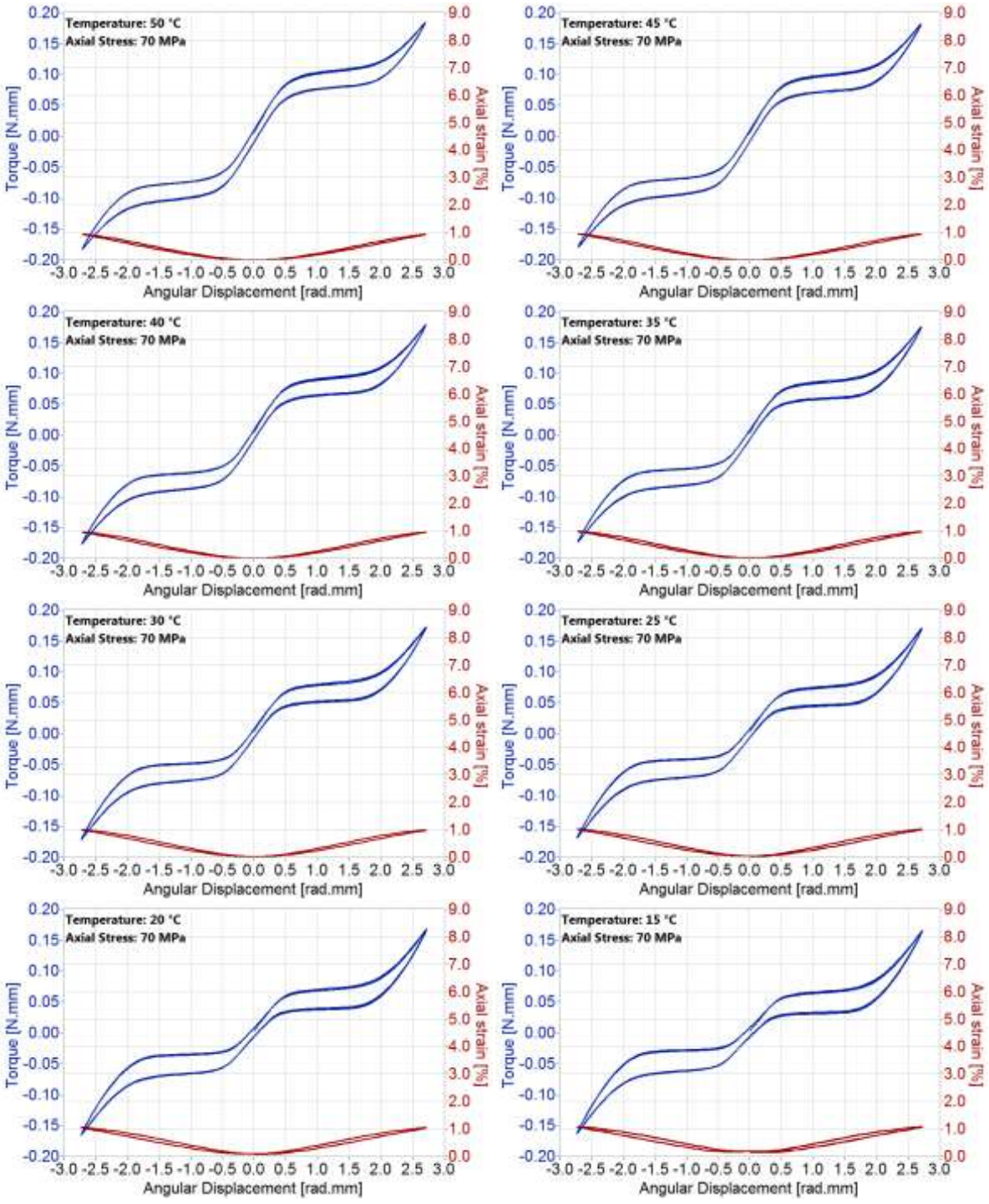
Dataset file labelling for Tension Tests

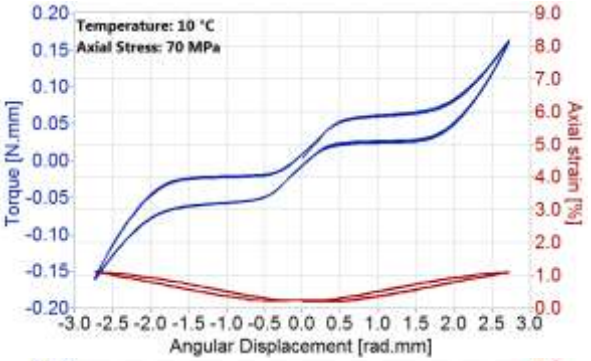
File name	content
tension_100cycle.txt	Training prior to regular tests
Stress-strain-n20C-t01.txt	Tensile test at T=-20C
Stress-strain-n10C-t01.txt	Tensile test at T=-10C
Stress-strain-0C-t01.txt	Tensile test at T=0C
Stress-strain-0C-t02.txt	Tensile test at T=0C
Stress-strain-10C-t01.txt	Tensile test at T=10C
Stress-strain-20C-t01.txt	Tensile test at T=20C
Stress-strain-40C-t01.txt	Tensile test at T=40C
Stress-strain-60C-t01.txt	Tensile test at T=60C
Stress-strain-partial-n20C-t01.txt	Tensile test with partial cycle at T=-20C
Stress-strain-partial-n10C-t01.txt	Tensile test with partial cycle at T=-10C
Stress-strain-partial-0C-t01.txt	Tensile test with partial cycle at T=0C
Stress-strain-partial-10C-t01.txt	Tensile test with partial cycle at T=0C
Stress-strain-partial-20C-t01.txt	Tensile test with partial cycle at T=10C
Stress-strain-partial-40C-t01.txt	Tensile test with partial cycle at T=20C
Stress-strain-partial-60C-t01.txt	Tensile test with partial cycle at T=40C
Recovery_strain_100MPa-t01.txt	2 cooling heating cycles [-20C, 100C] at applied stress 100MPa
Recovery_strain_200MPa-t01.txt	2 cooling heating cycles [-20C, 100C] at applied stress 200MPa
Recovery_strain_300MPa-t01.txt	2 cooling heating cycles [-20C, 100C] at applied stress 300MPa
Recovery_strain_400MPa-t01.txt	2 cooling heating cycles [-20C, 100C] at applied stress 400MPa
Recovery_strain_400MPa-t02.txt	2 cooling heating cycles [-20C, 100C] at applied stress 400MPa
Recovery_strain_450MPa-t01.txt	2 cooling heating cycles [-20C, 100C] at applied stress 450MPa
Recovery_strain_500MPa-t01.txt	2 cooling heating cycles [-20C, 100C] at applied stress 500MPa
Recovery_stress_upper2-t01.txt	Recovery stress test, prestrain 2%, upper plateau
Recovery_stress_lower2-t01.txt	Recovery stress test, prestrain 2%, lower plateau
Recovery_stress_upper3p5-t01.txt	Recovery stress test, prestrain 3.5%, upper plateau
Recovery_stress_lower3p5-t01.txt	Recovery stress test, prestrain 3.5%, lower plateau
Recovery_stress_upper5-t01.txt	Recovery stress test, prestrain 5%, upper plateau
Recovery_stress_lower5-t01.txt	Recovery stress test, prestrain 5%, lower plateau

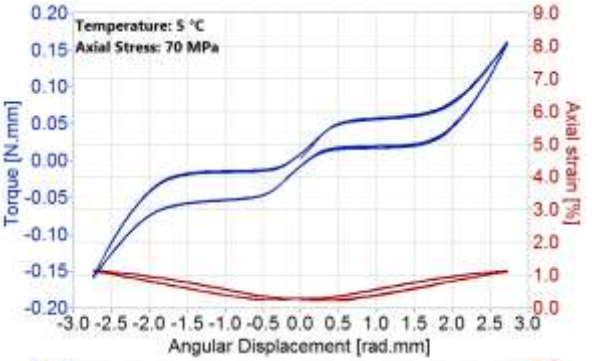
Result Preview

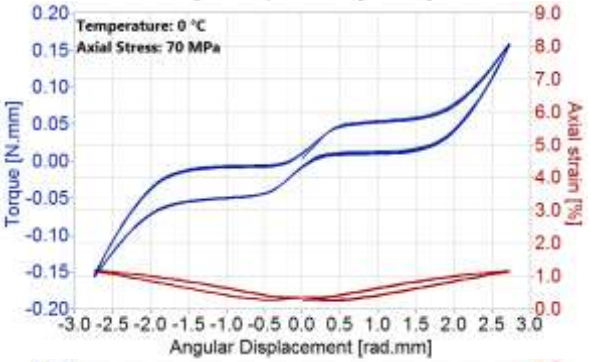
Torsion Tests

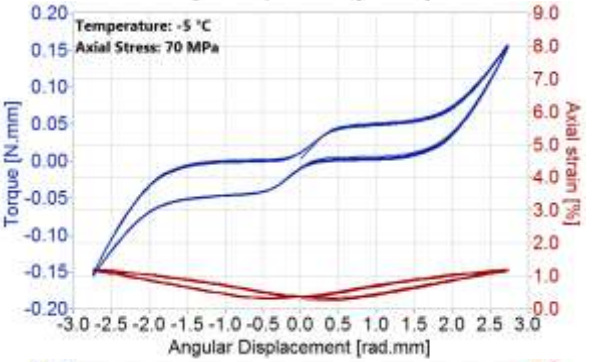
Constant axial stress - 70 MPa

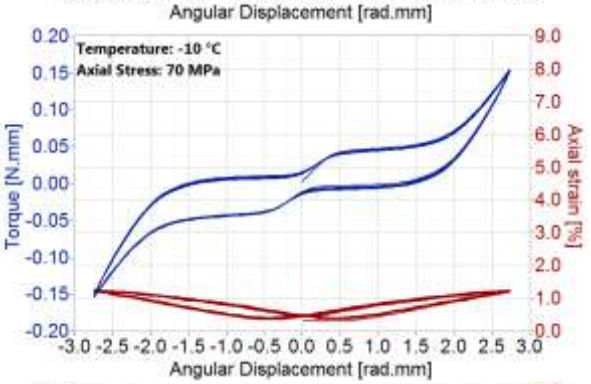


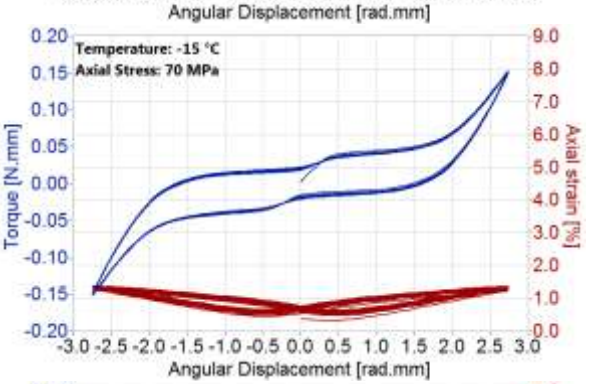

Temperature: 10 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

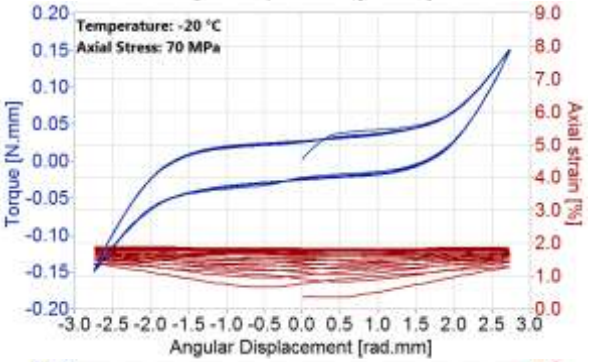

Temperature: 5 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

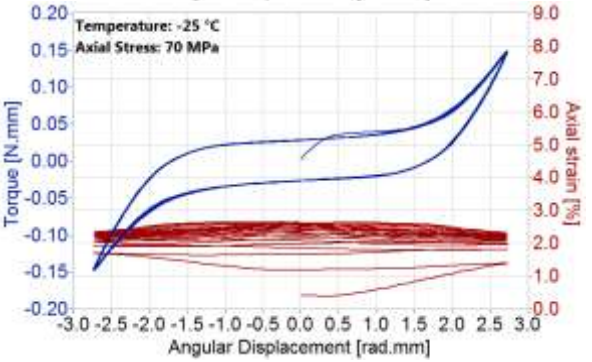

Temperature: 0 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

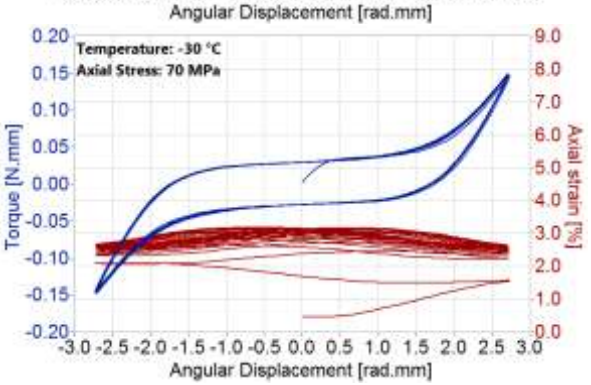

Temperature: -5 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]


Temperature: -10 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]


Temperature: -15 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

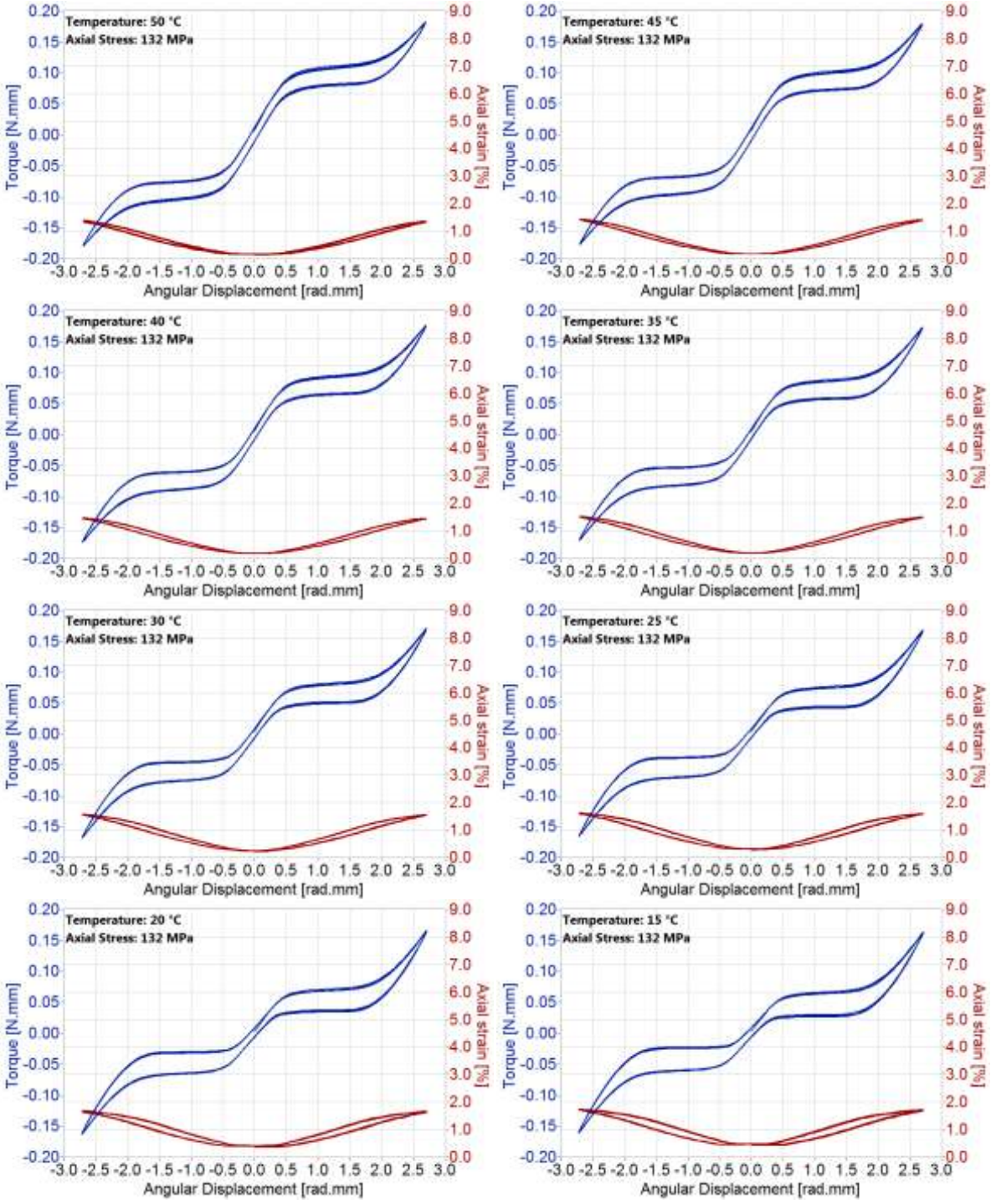

Temperature: -20 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

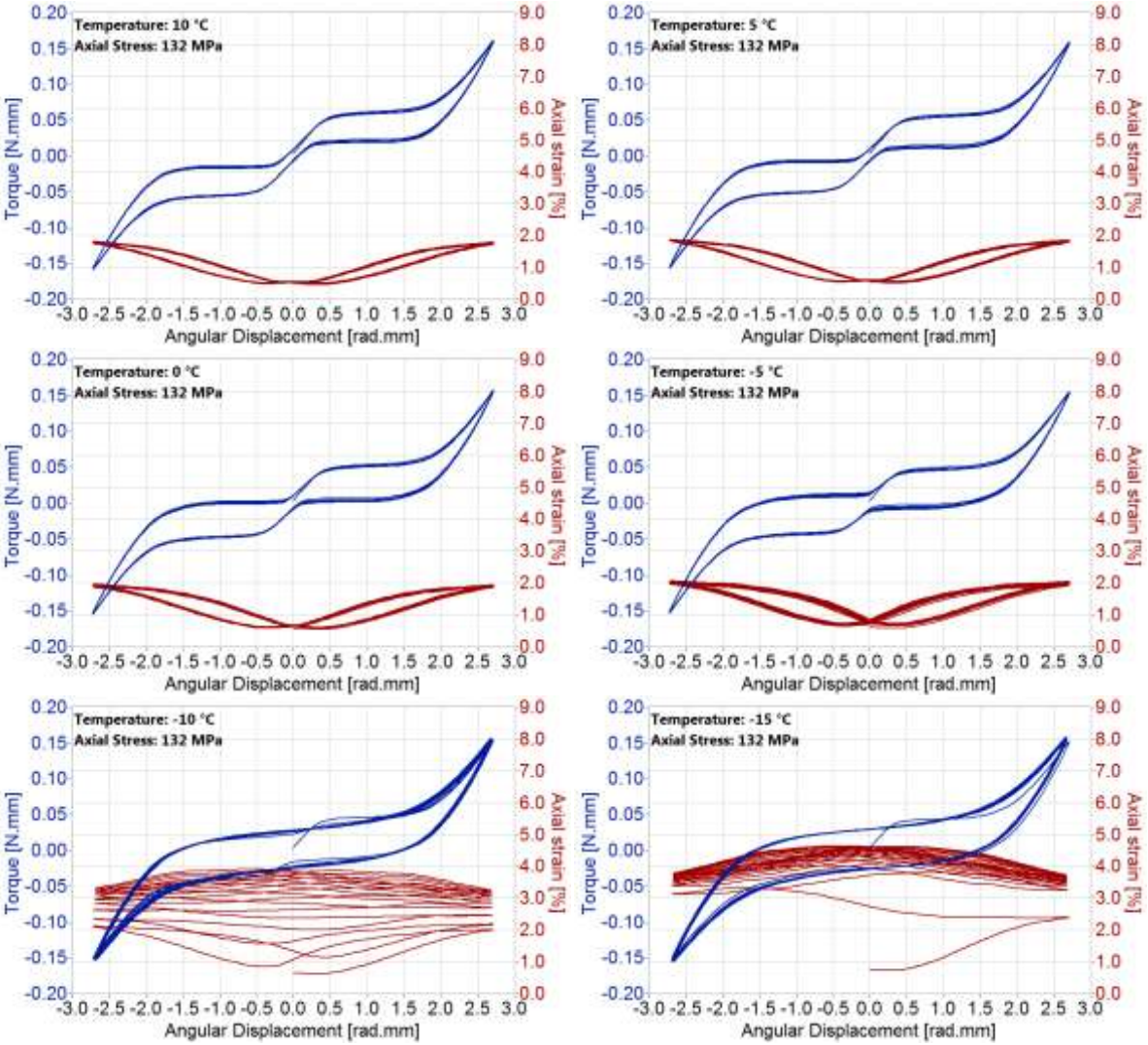

Temperature: -25 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]


Temperature: -30 °C
Axial Stress: 70 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

Torsion Test

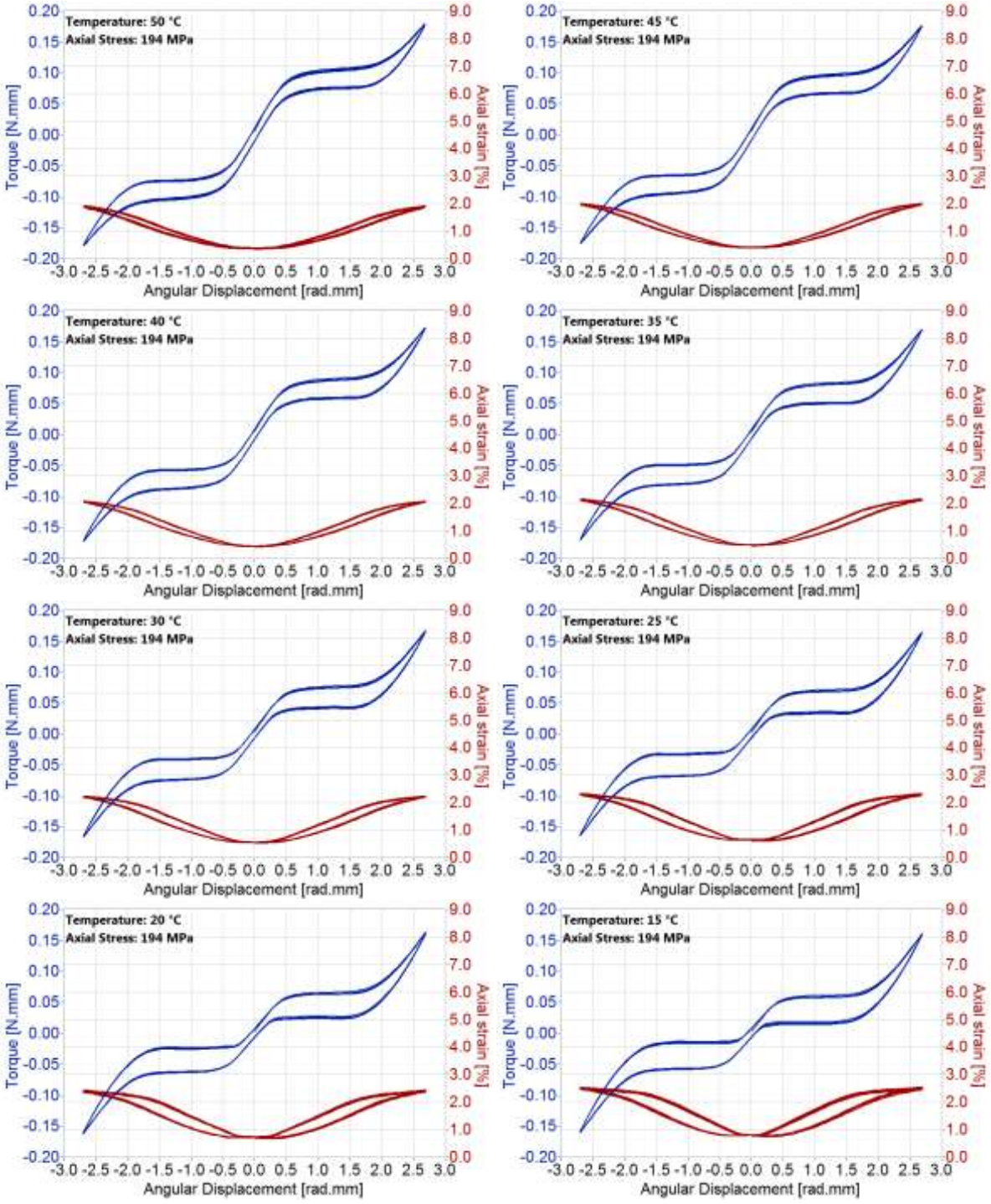
Constant axial stress - 132 MPa

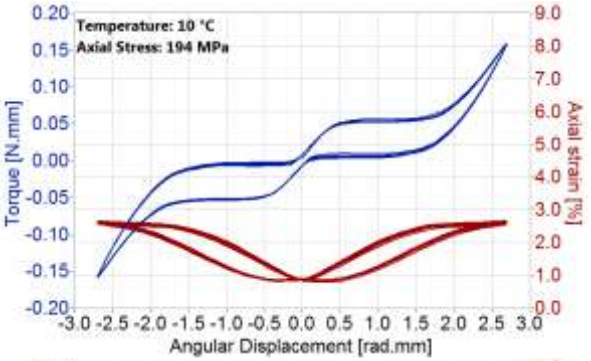


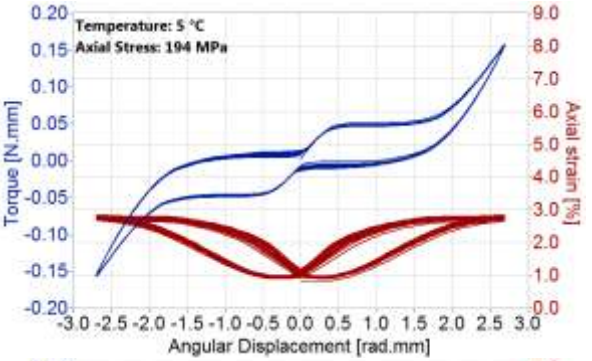

Temperature: 10 °C
Axial Stress: 132 MPa
Temperature: 5 °C
Axial Stress: 132 MPa
Temperature: 0 °C
Axial Stress: 132 MPa
Temperature: -5 °C
Axial Stress: 132 MPa
Temperature: -10 °C
Axial Stress: 132 MPa
Temperature: -15 °C
Axial Stress: 132 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

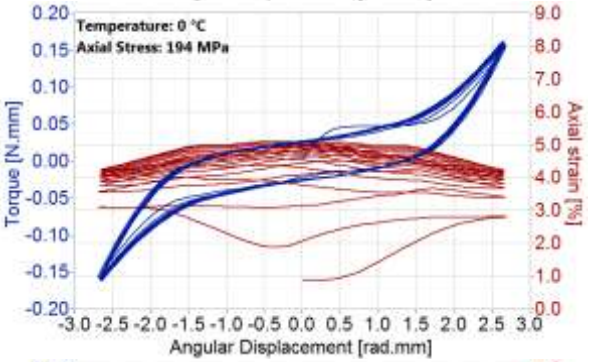
Torsion Test

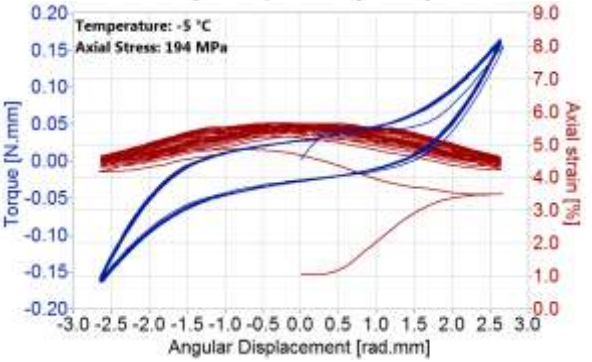
Constant axial stress - 194 MPa

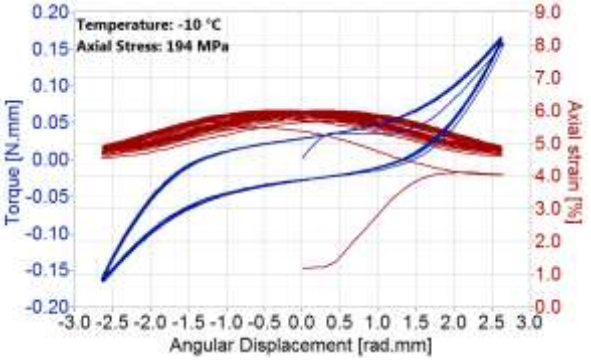



Temperature: 10 °C
Axial Stress: 194 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]


Temperature: 5 °C
Axial Stress: 194 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

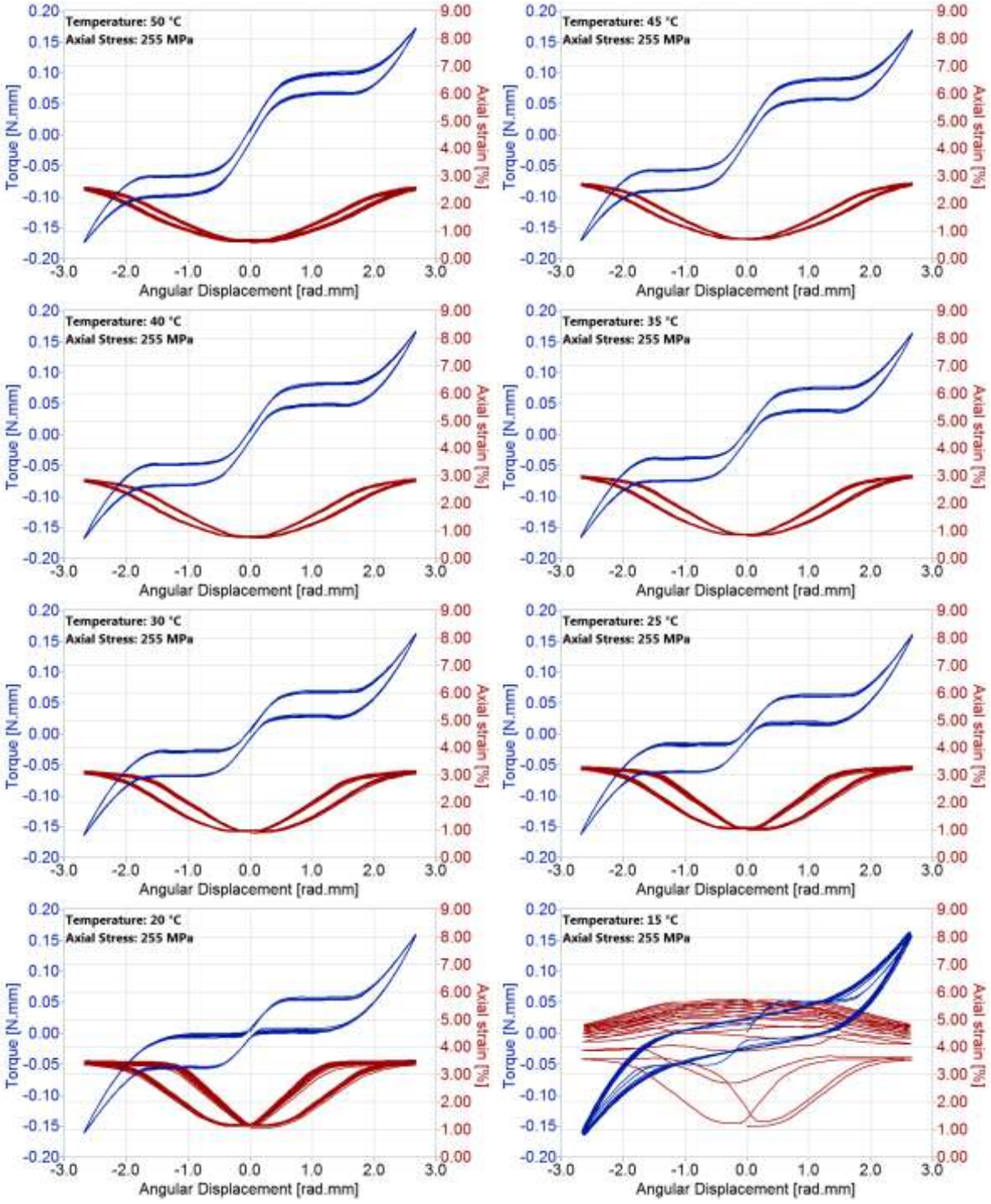

Temperature: 0 °C
Axial Stress: 194 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

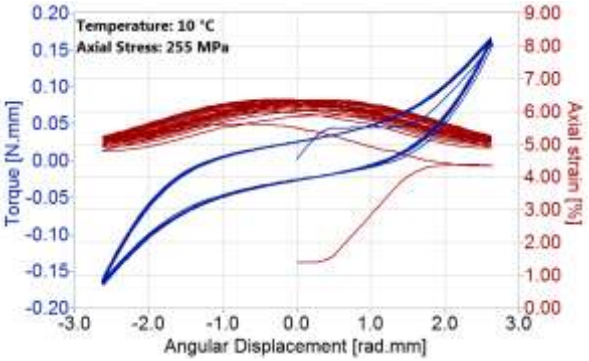

Temperature: -5 °C
Axial Stress: 194 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

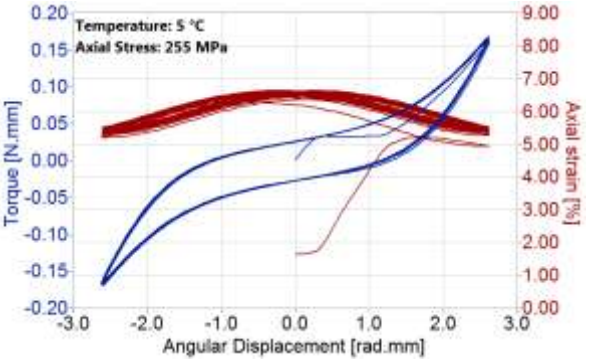

Temperature: -10 °C
Axial Stress: 194 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

Torsion Test

Constant axial stress - 255 MPa

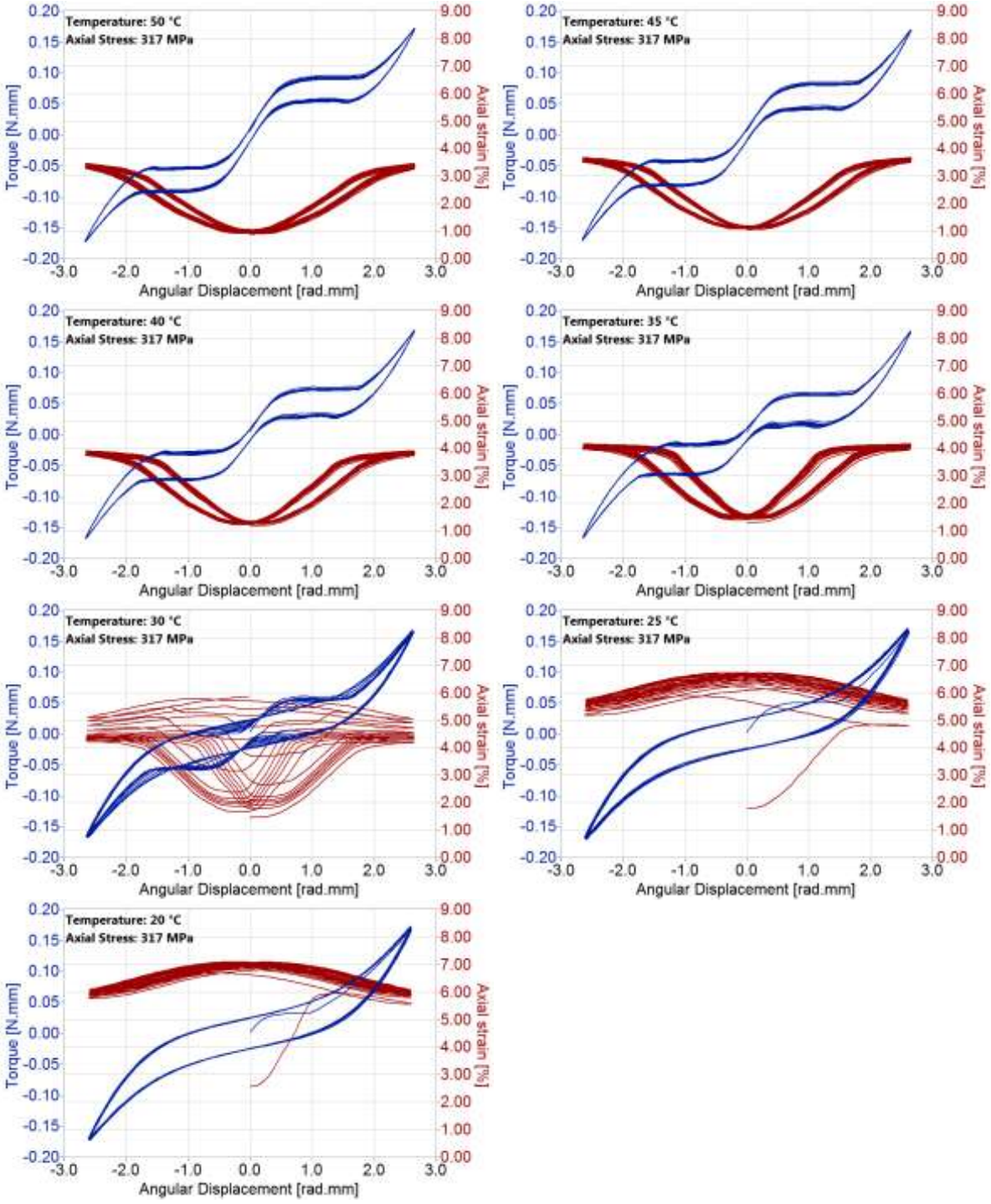



Temperature: 10 °C
Axial Stress: 255 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]


Temperature: 5 °C
Axial Stress: 255 MPa
Torque [N.mm]
Axial strain [%]
Angular Displacement [rad.mm]

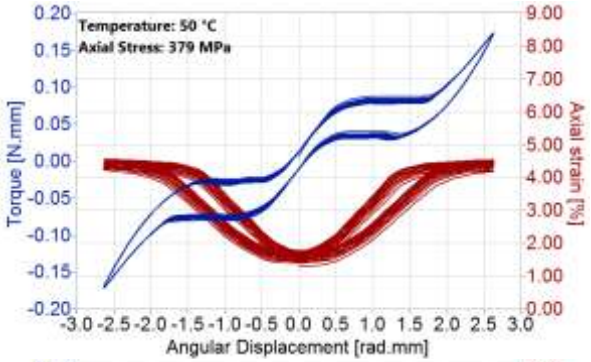
Torsion Test

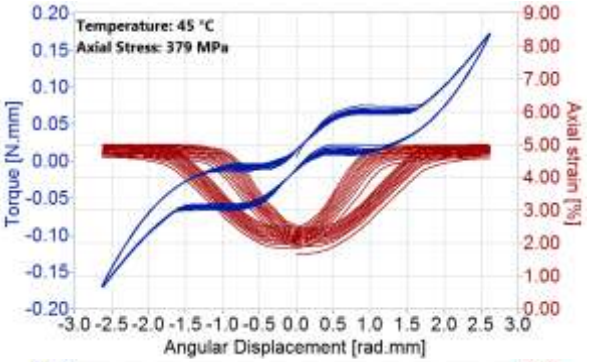
Constant axial stress - 317 MPa

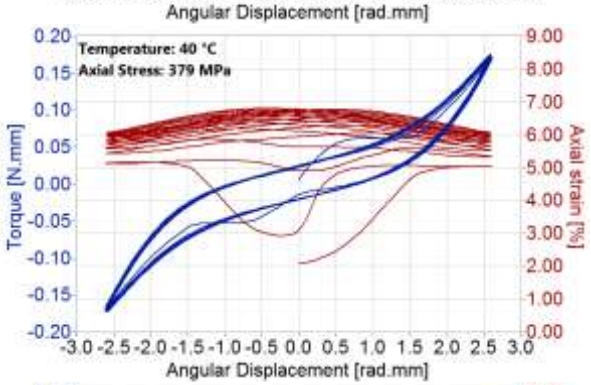


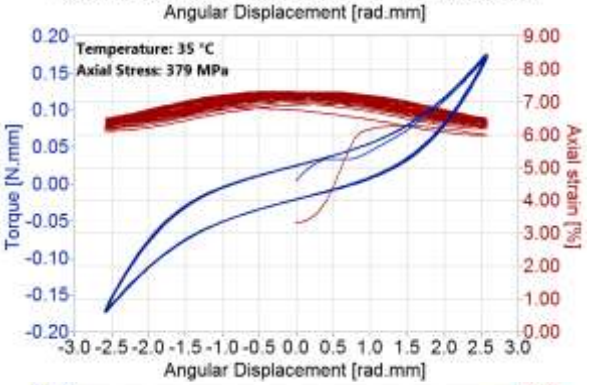
Torsion Test

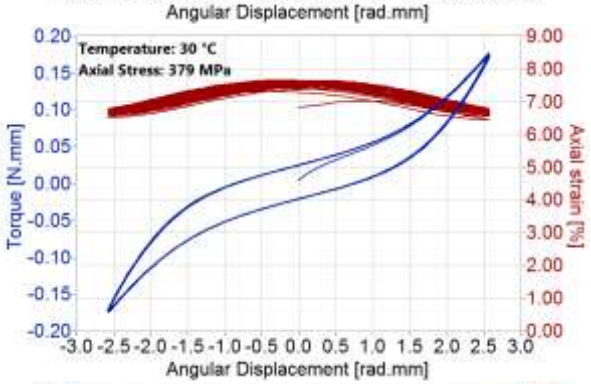
Constant axial stress - 379 MPa

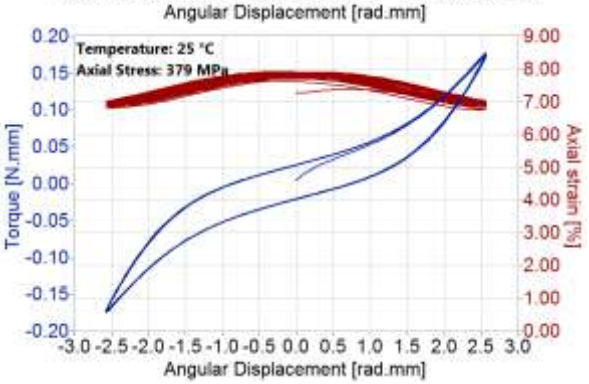


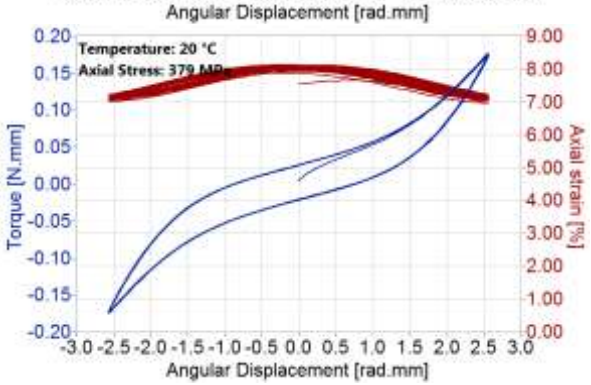






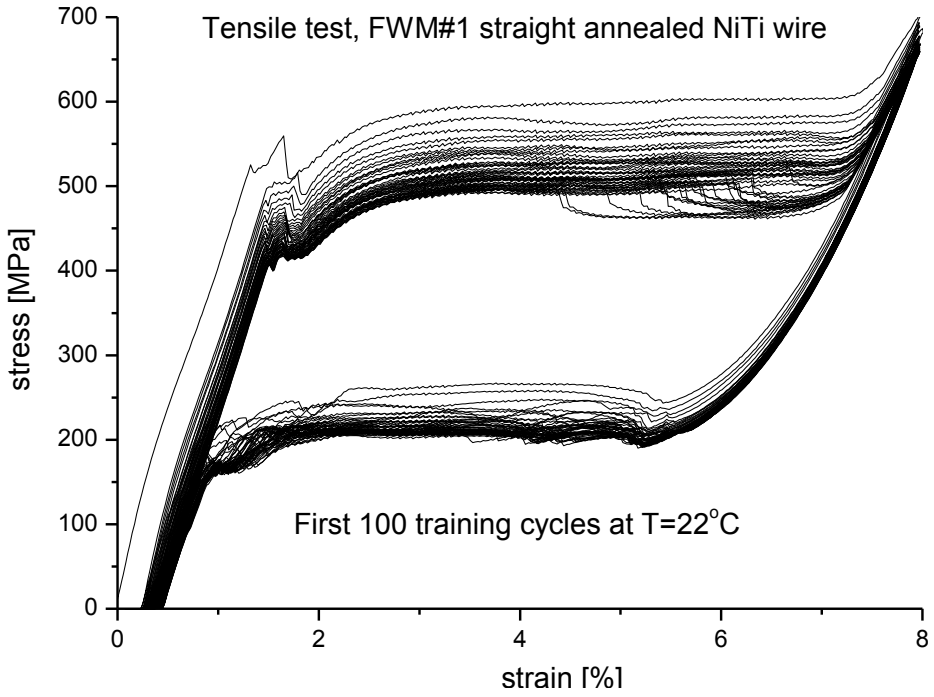




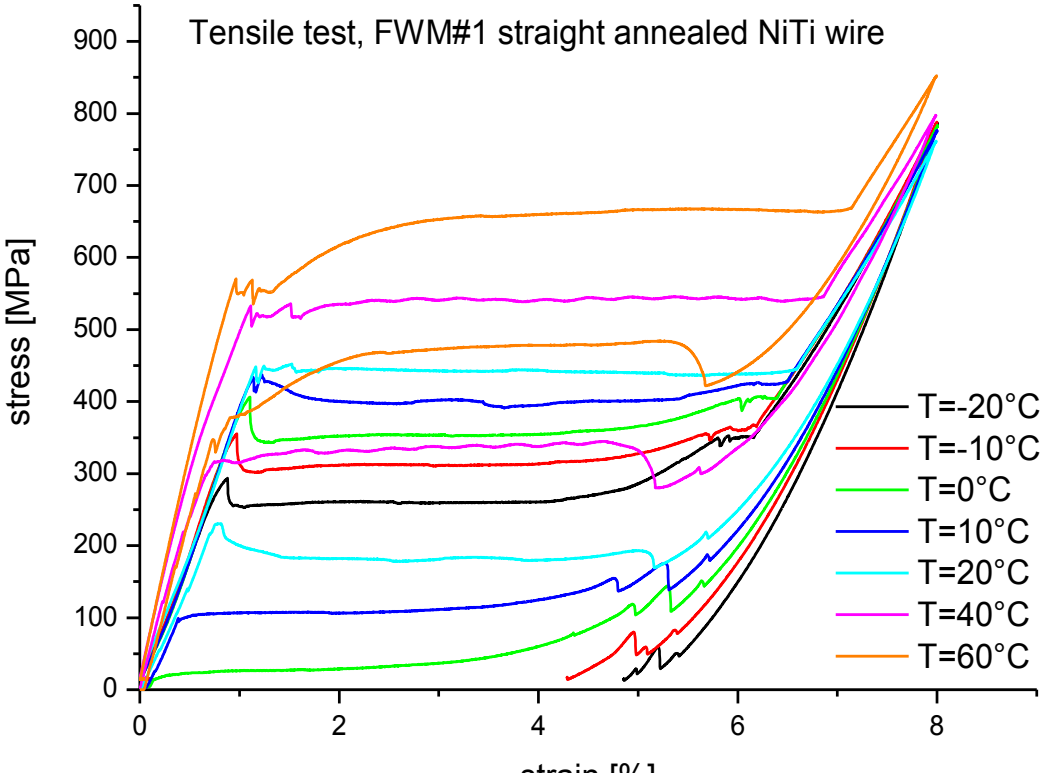


Tensile Tests

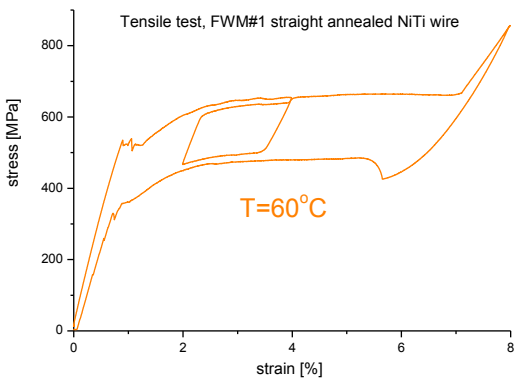
Preliminary training

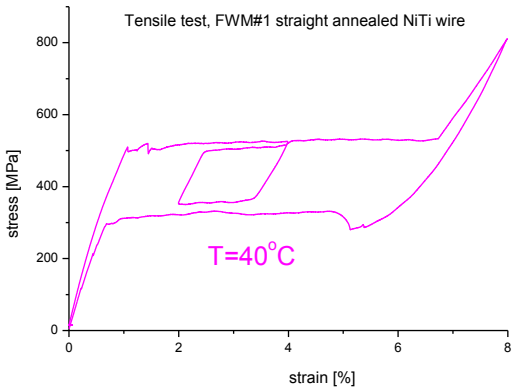


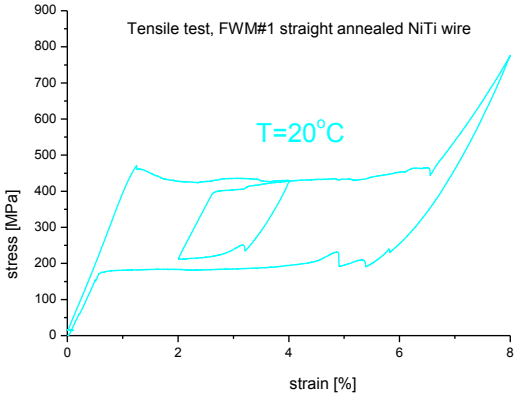
Tensile tests at different temperatures

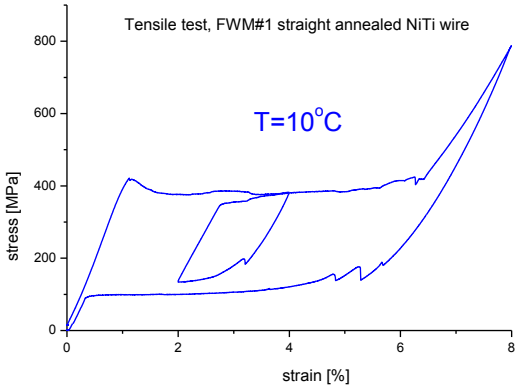


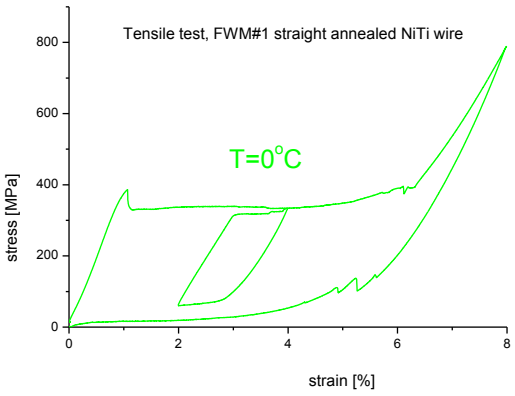
Partial tensile tests at different temperatures

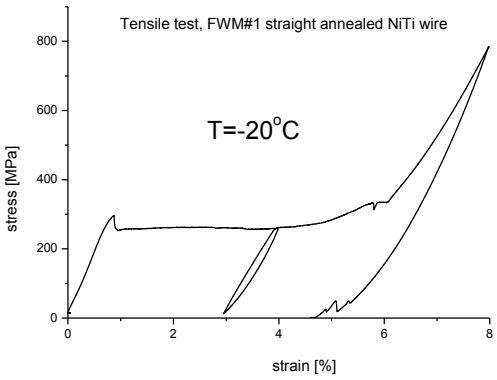




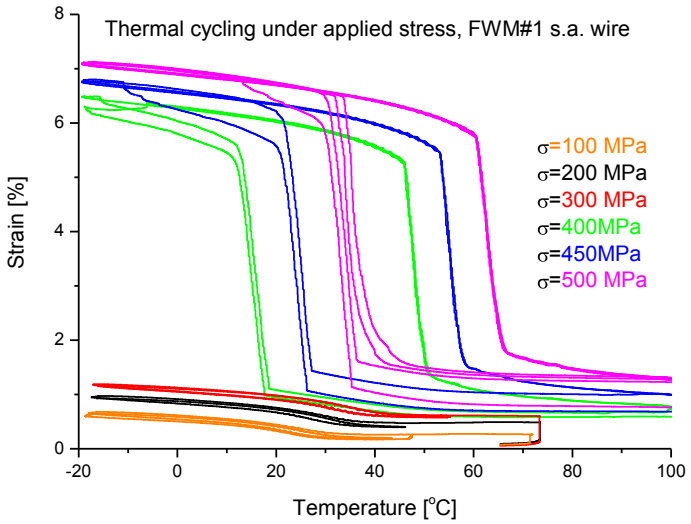


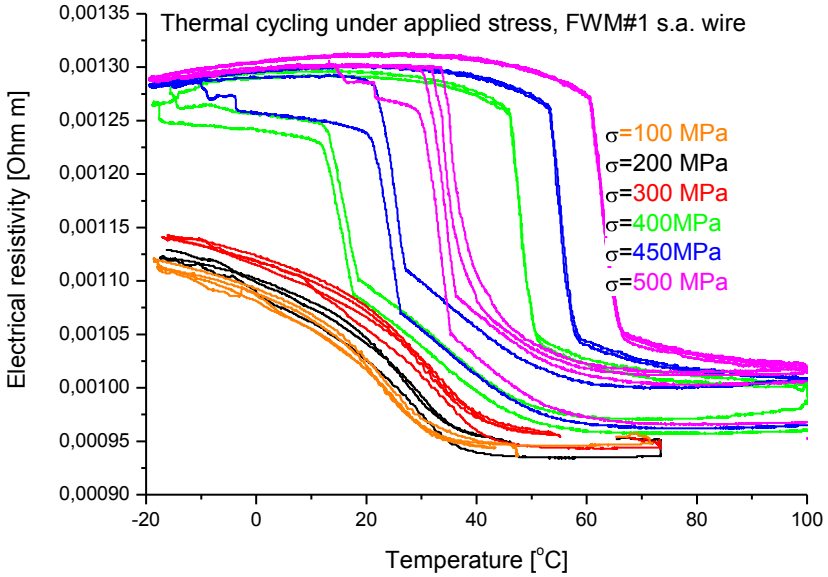




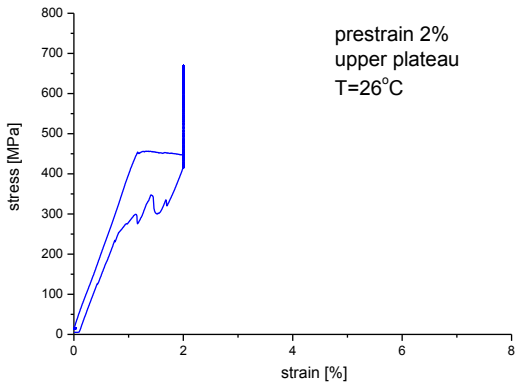


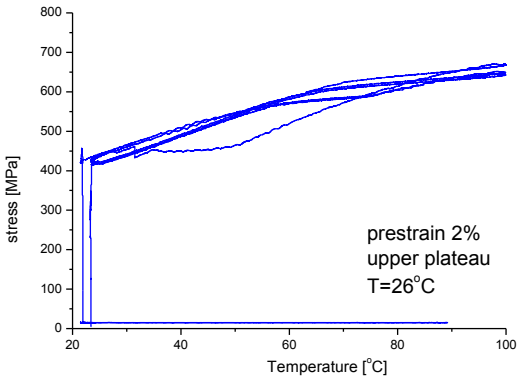
Thermal cycle through transformation interval under various tensile constant stresses

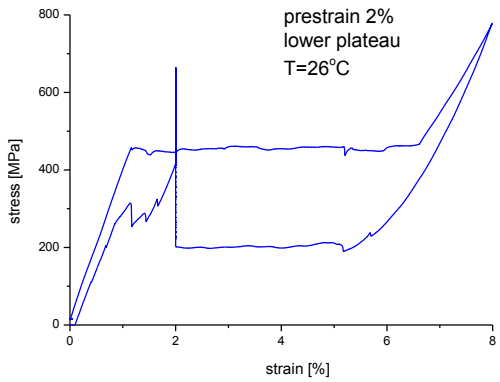


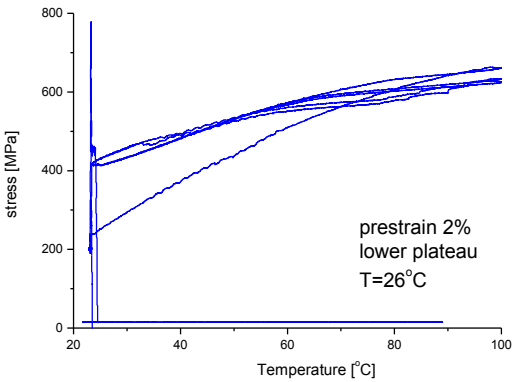


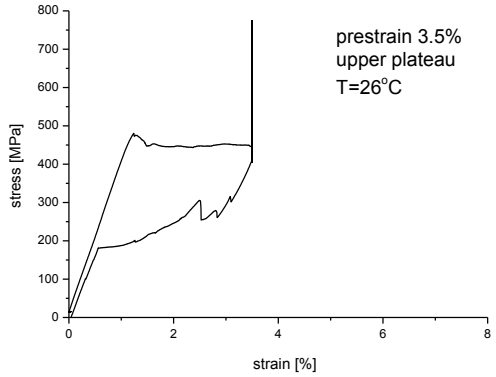
Thermomechanical recovery stress tests

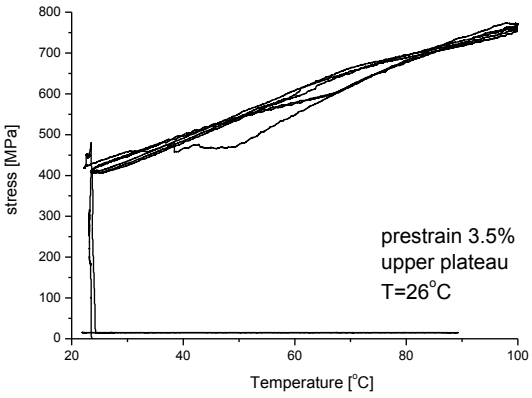


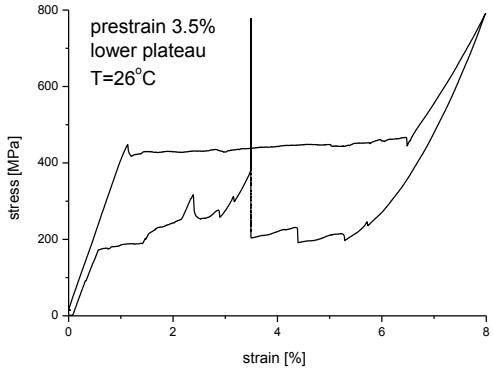


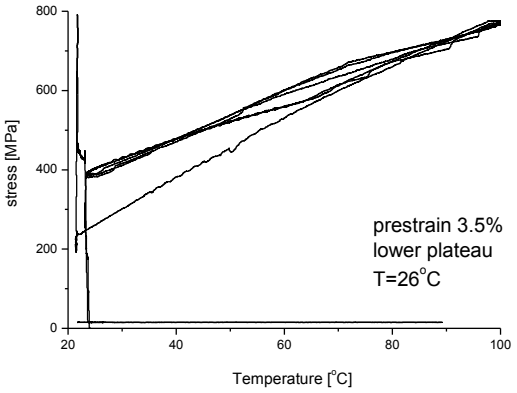


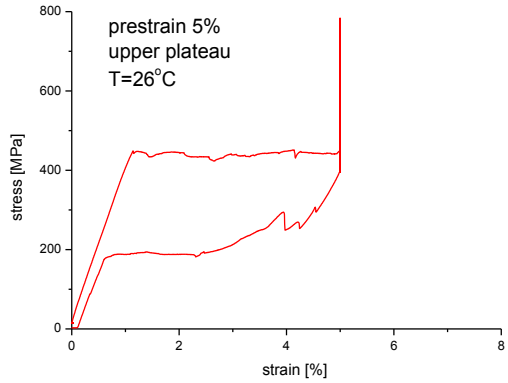


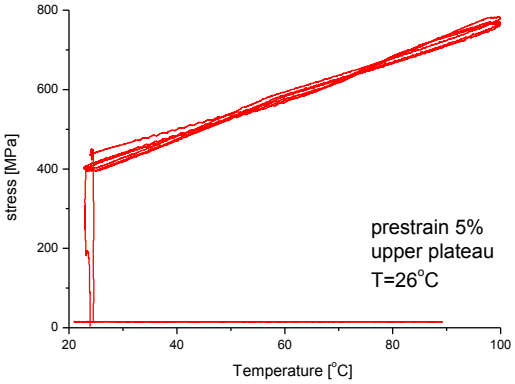


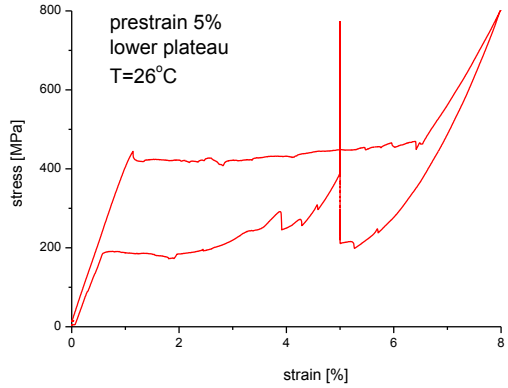


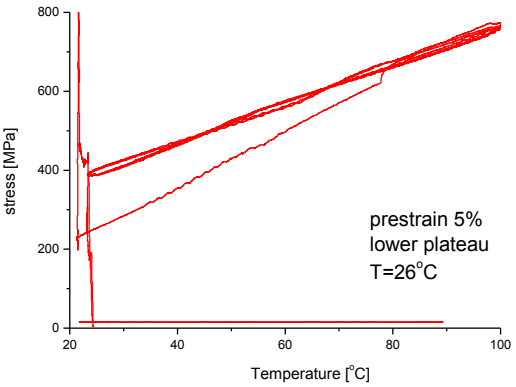

prestrain 3.5%
lower plateau
T=26°C
stress [MPa]
strain [%]


prestrain 3.5%
lower plateau
T=26°C
stress [MPa]
Temperature [°C]


prestrain 5%
upper plateau
T=26°C
stress [MPa]
strain [%]


prestrain 5%
upper plateau
T=26°C
stress [MPa]
Temperature [°C]


prestrain 5%
lower plateau
T=26°C
stress [MPa]
strain [%]


prestrain 5%
lower plateau
T=26°C
stress [MPa]
Temperature [°C]