

# Resistance Behavior of Transforming Material

T Kotil\* and H Sehitoglu

Department of Mechanical and Industrial Engineering  
University of Illinois at Urbana-Champaign

Y. I. Chumlyakov

Siberian Physical and Technical Institute, Tomsk, Russia

\* Currently at sabbatical leave from Aerospace Engineering Department  
Istanbul Technical University, Istanbul, Turkey

# Electrical Resistance Behavior Of Transforming Material

- Martensitic Transformation of Shape Memory Alloys
- Electrical Resistance Measurement Techniques and Application in Material Science
- Variation of Electrical Resistance During Thermal and Mechanical Loading of the Shape Memory Alloys
- Conclusion

# Martensitic Transformation of Shape Memory Alloys

- Martensitic Transformation
- Determination of the Transformation
  - Strain Measurement
  - Neutron Diffraction Techniques
  - Electrical Resistance Measurement
- Application of the Shape Memory Materials
  - Non-Medical Application
  - Medical Application

# Electrical Resistance Measurement and Application in Material Science

- Micro-Ohm Resistance Measurement
- Slip Nucleation and Plastic Deformation
- Determination of the Fatigue Life
- Mechanical Behavior of the Thin Film
- Transformation Behavior of Shape Memory Alloys

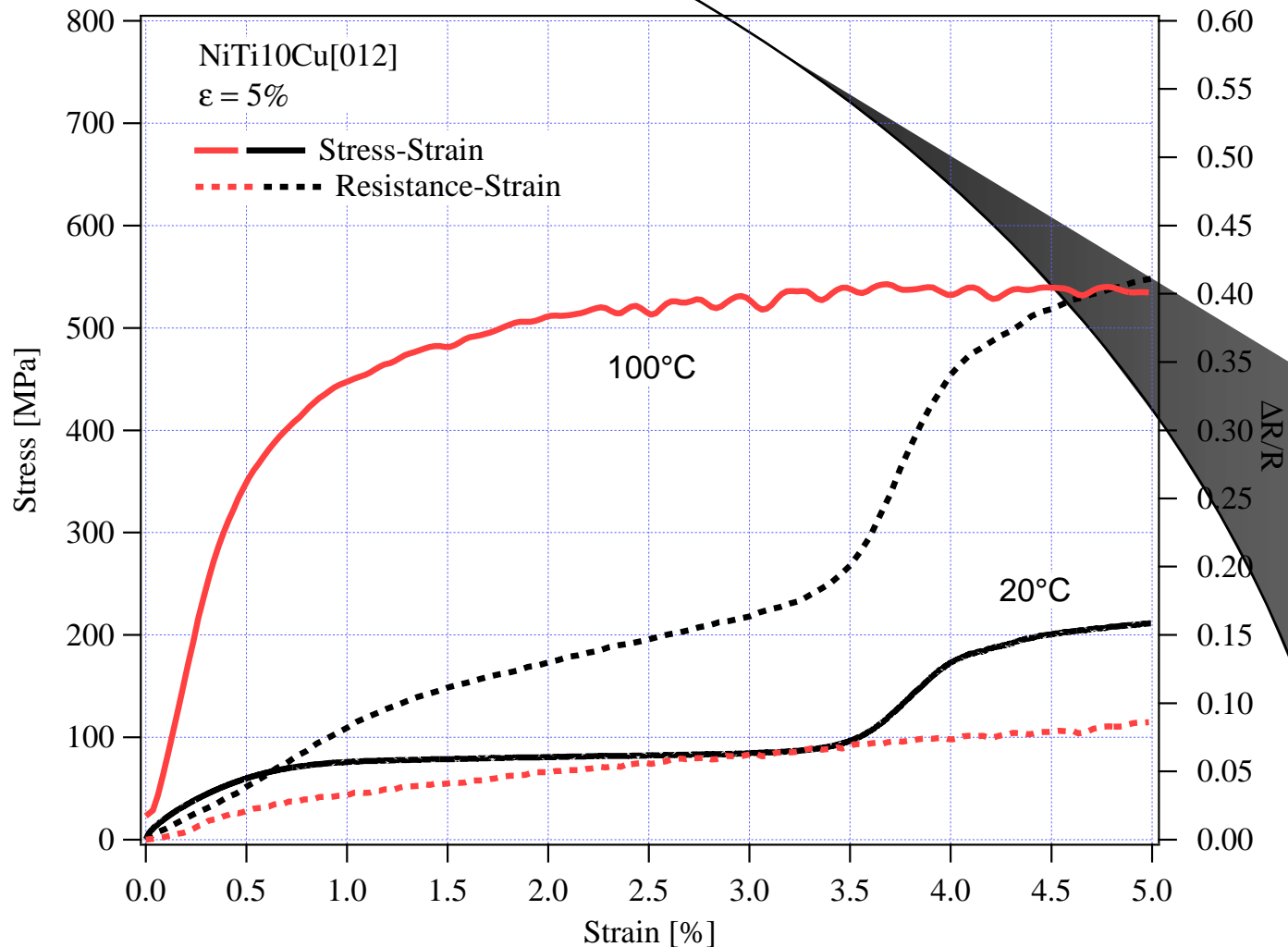
# Experimental System



Mechanical and Industrial Engineering Department, The University of Illinois at Urbana-Champanig

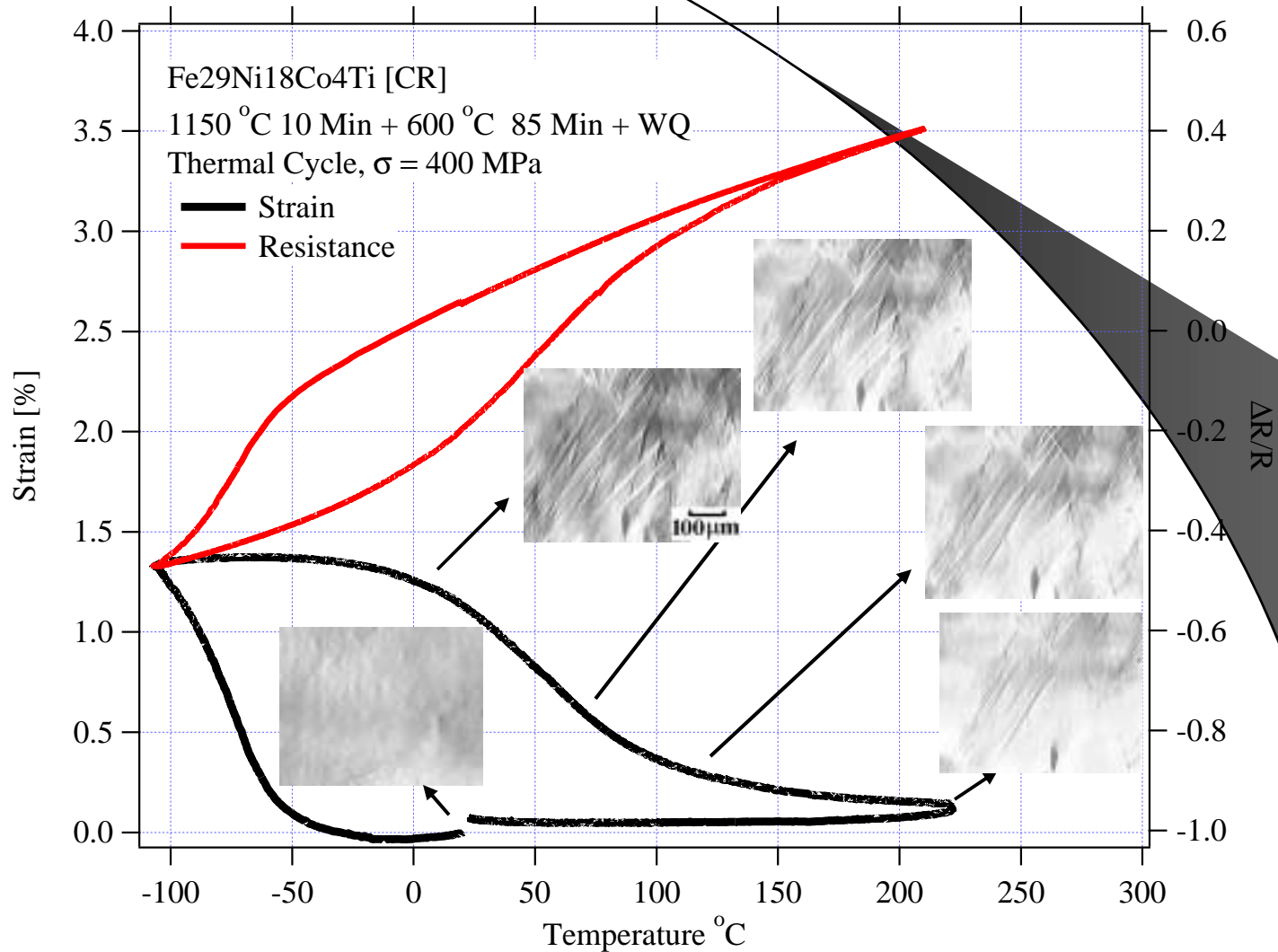
# Monotonic Tensile Loading

(NiTi10Cu Shape Memory Material)



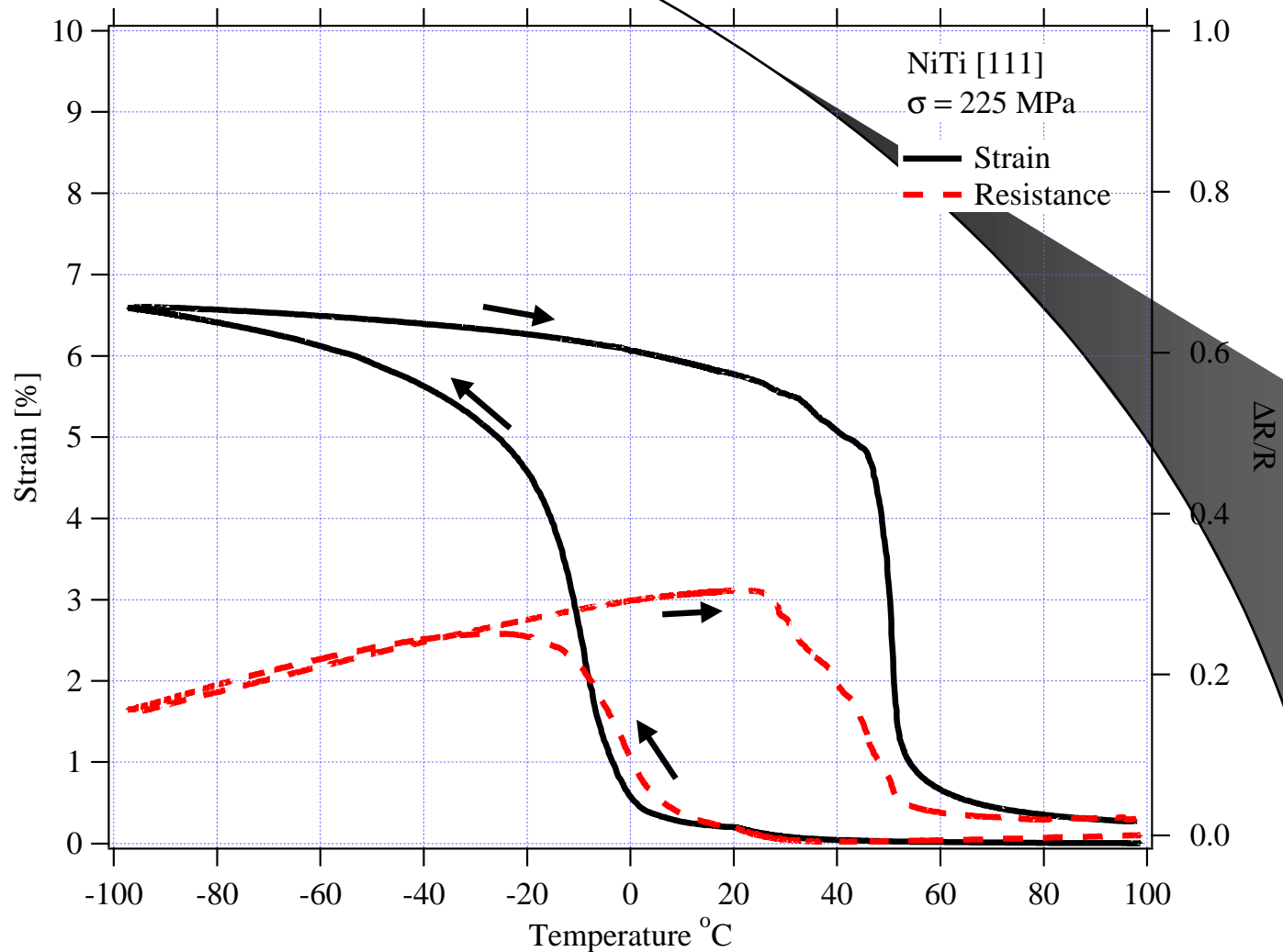
# Thermal Cycle Test

(Fe<sub>29</sub>Ni<sub>18</sub>Co<sub>4</sub>Ti Shape Memory Material)



# Thermal Cycle Test

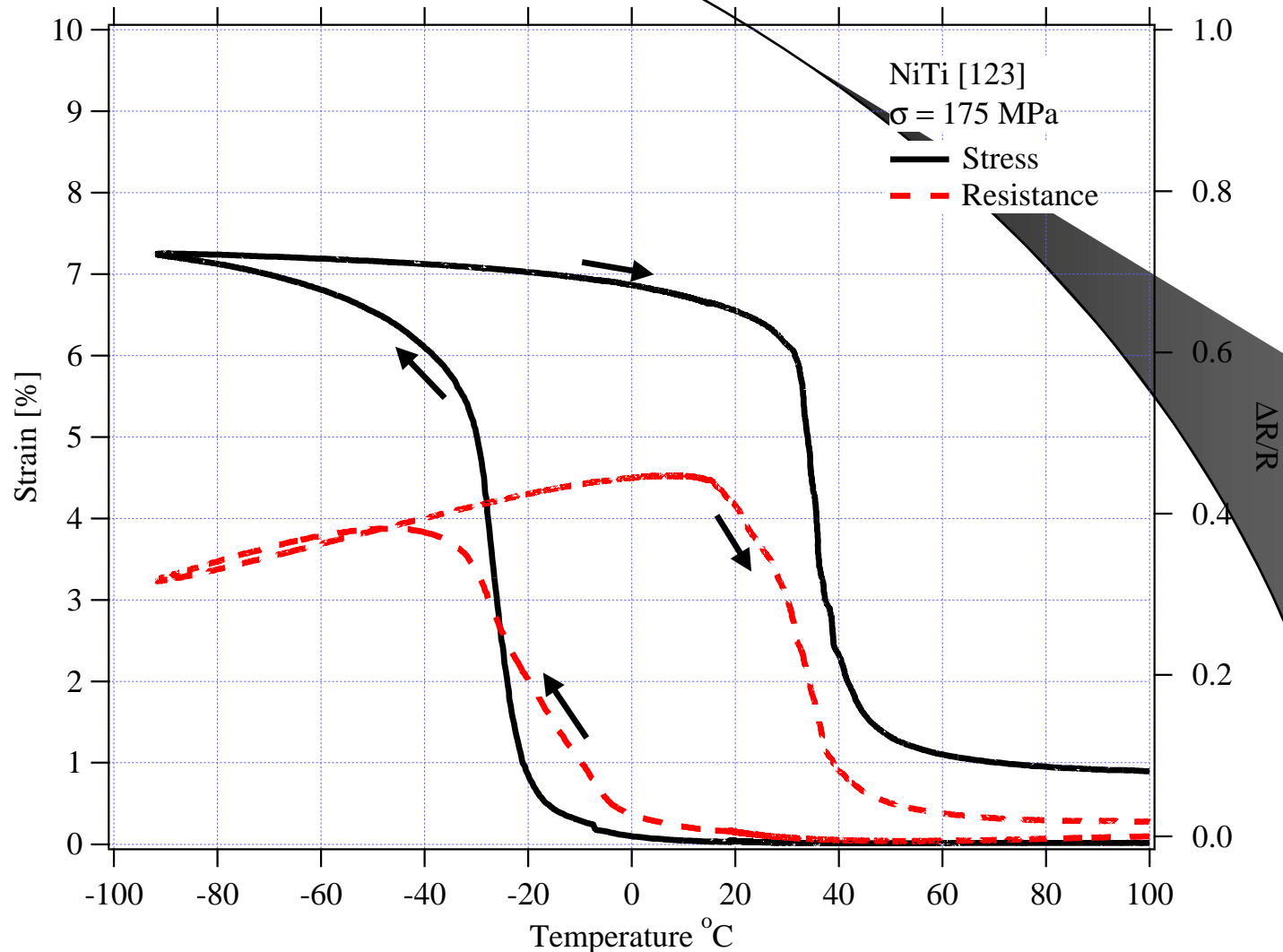
(NiTi Shape Memory Material)





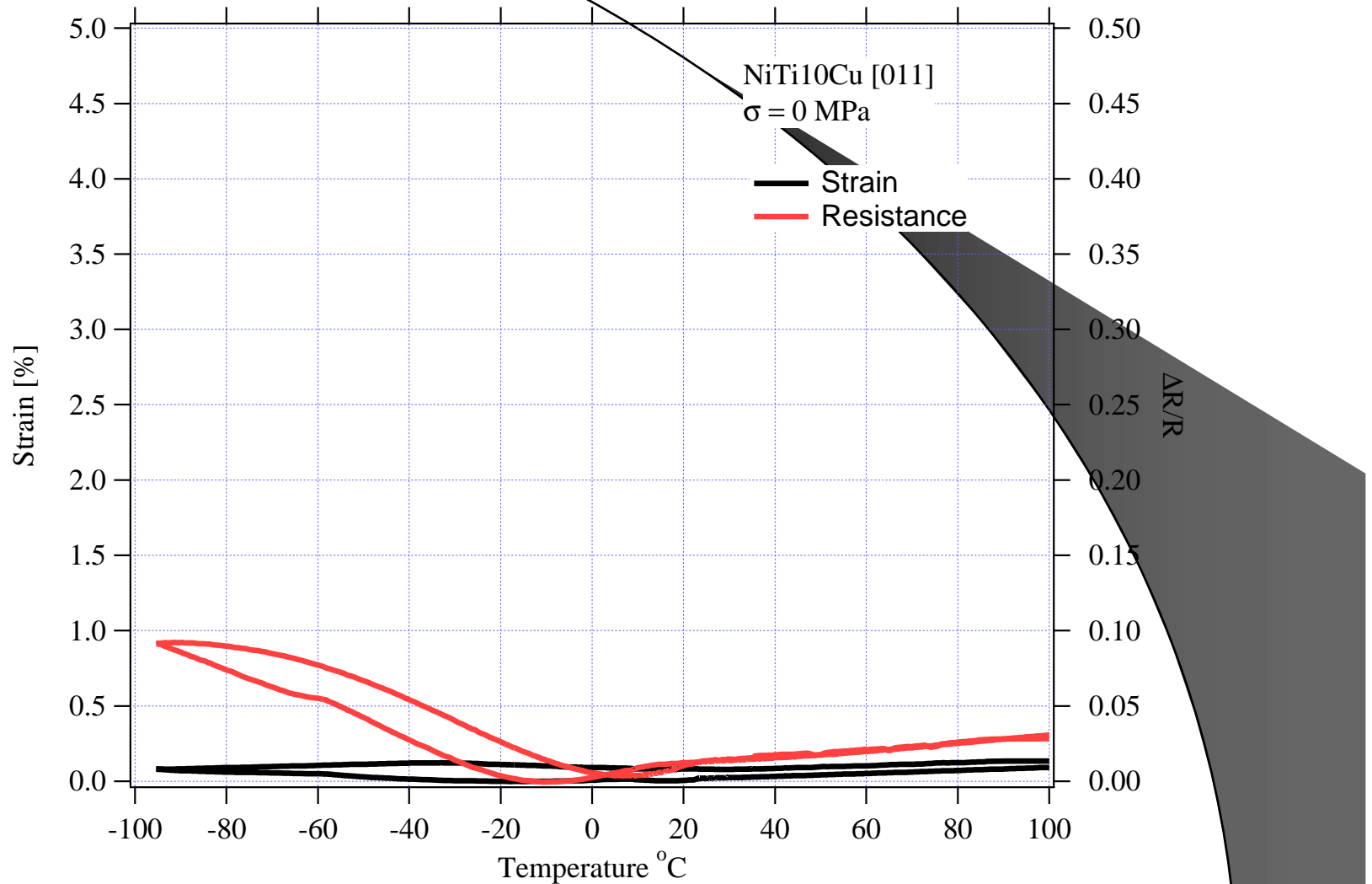
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(NiTi Shape Memory Material)



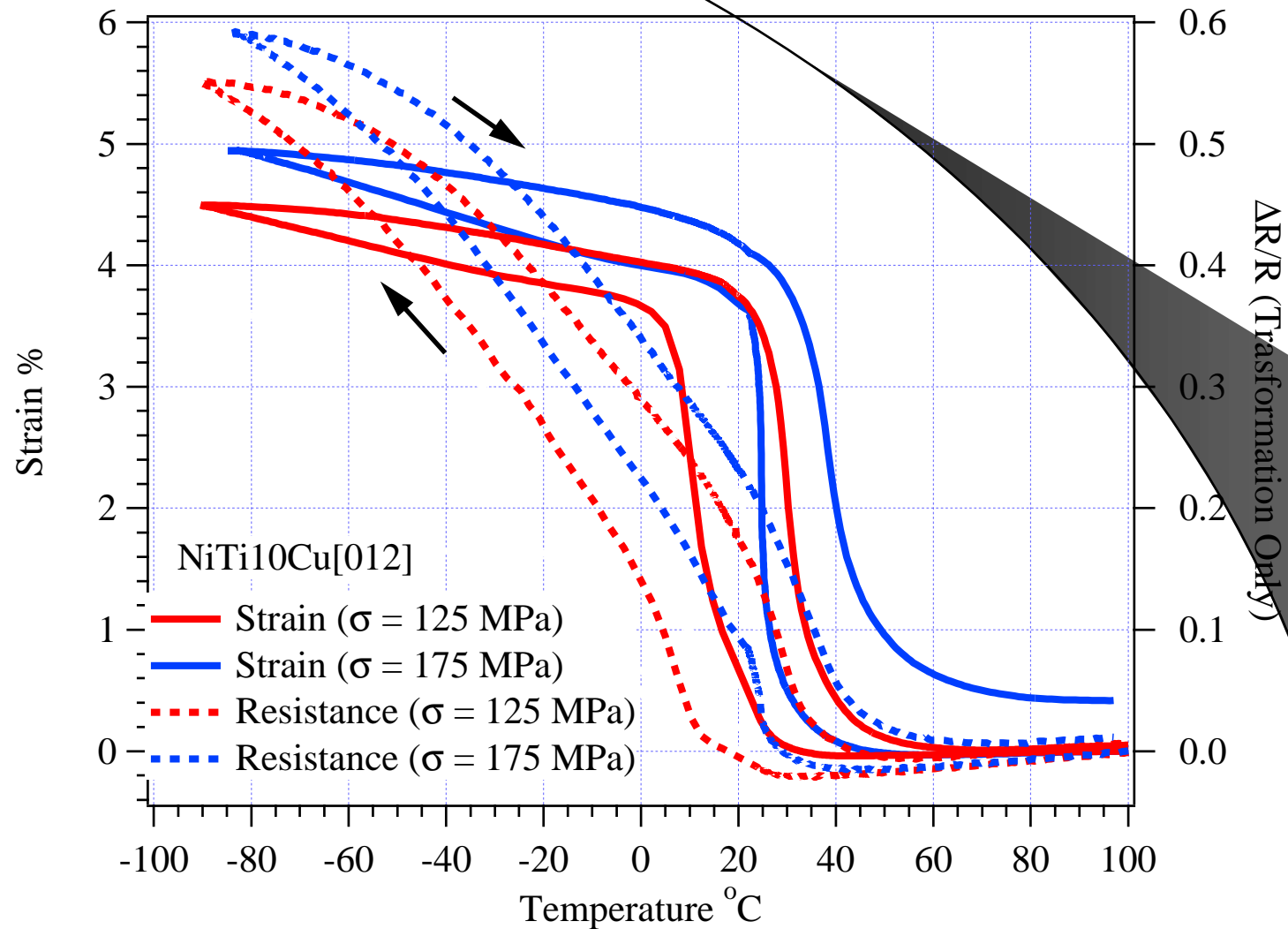
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(NiTi10Cu Shape Memory Material)



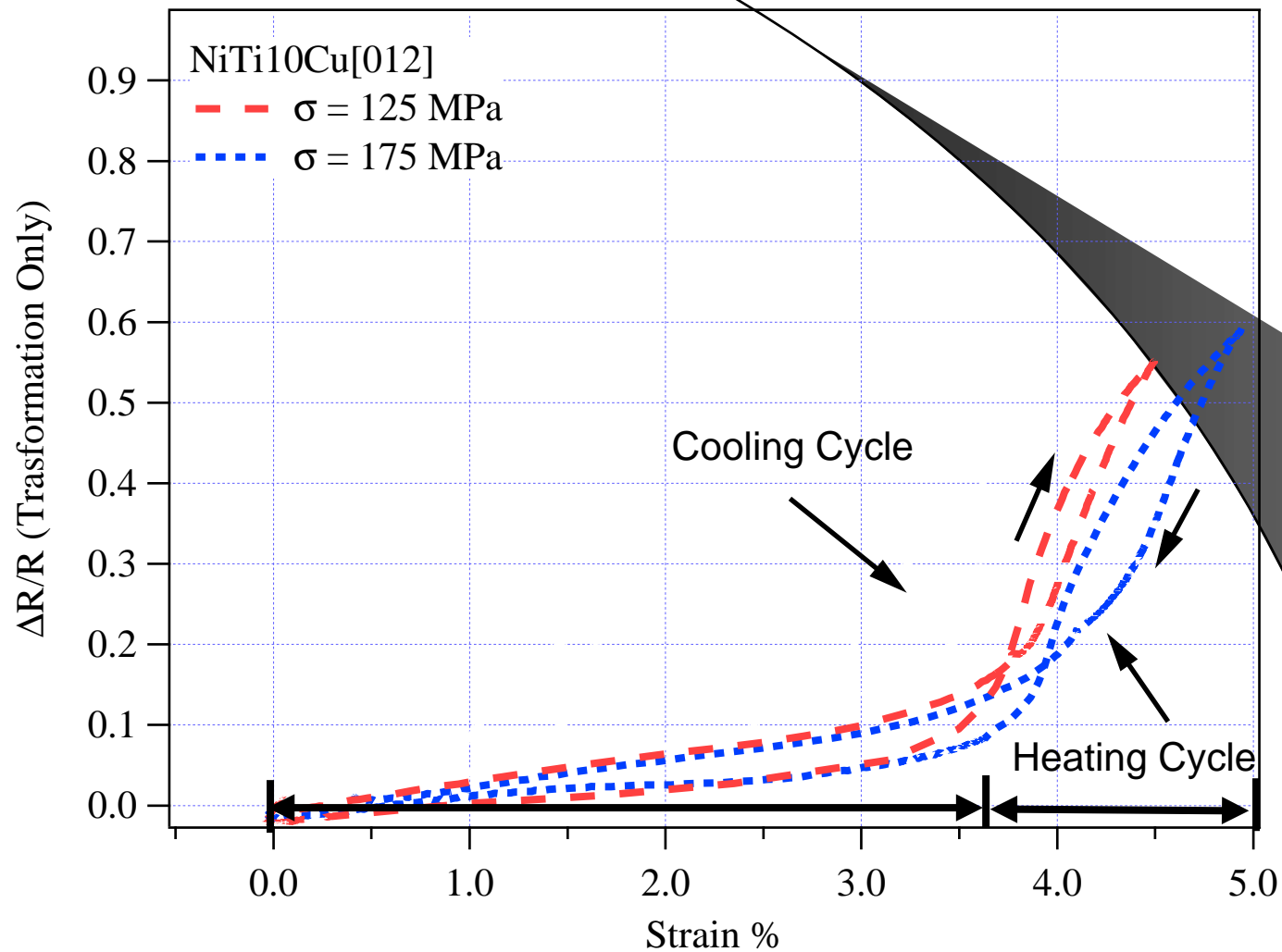
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(NiTi10Cu Shape Memory Material)



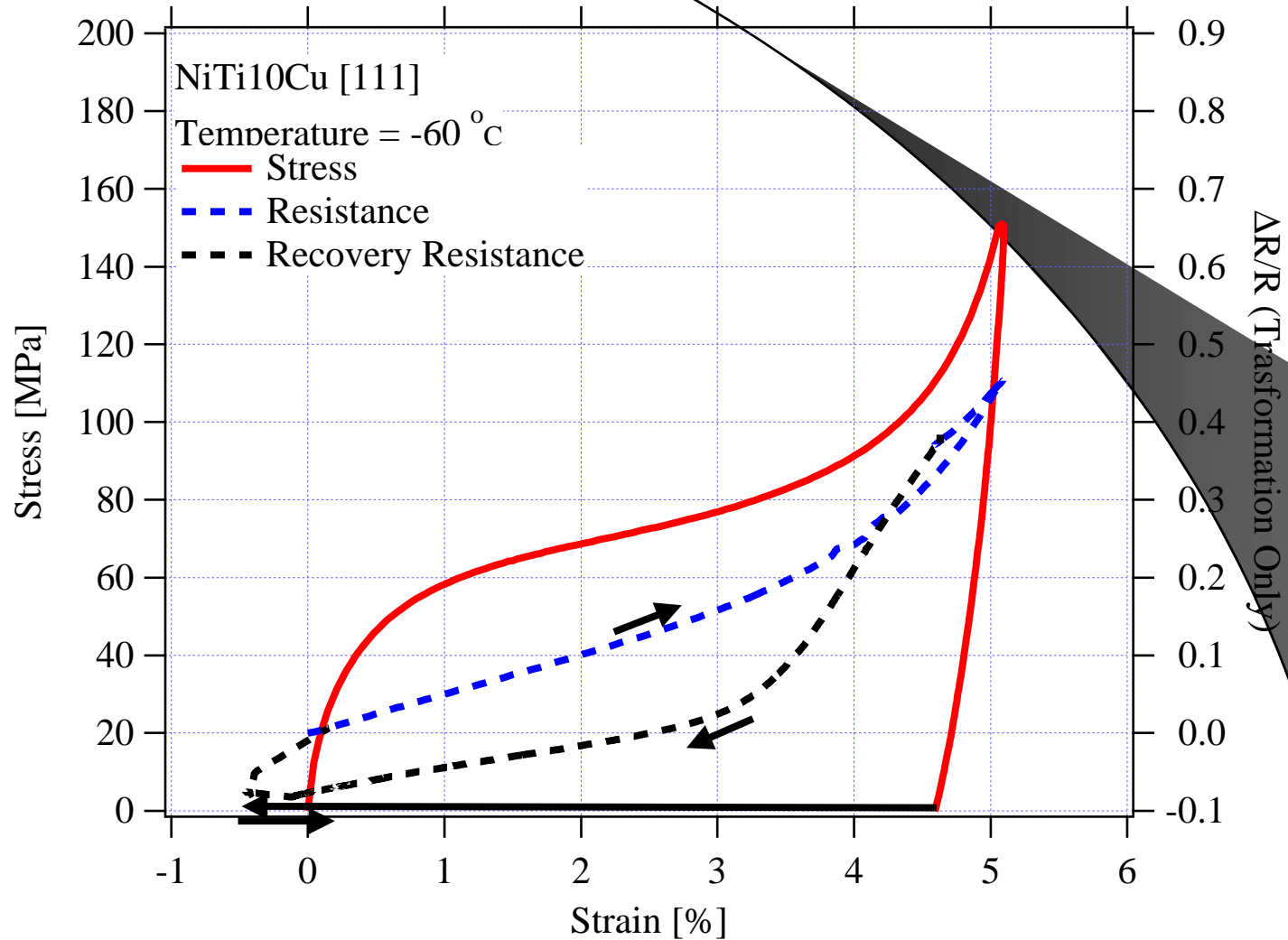
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(NiTi10Cu Shape Memory Material)



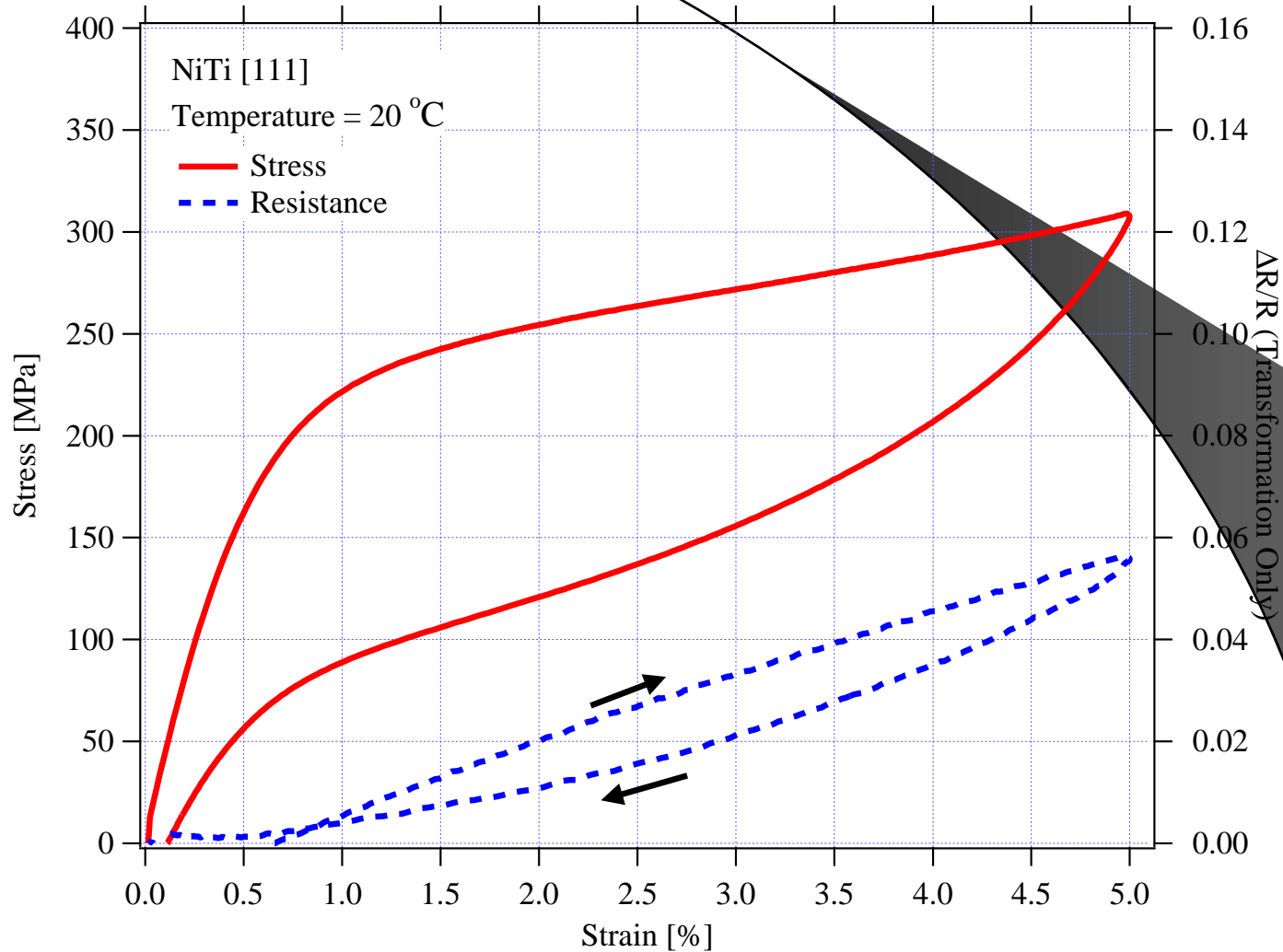
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(NiTi10Cu Shape Memory Material)



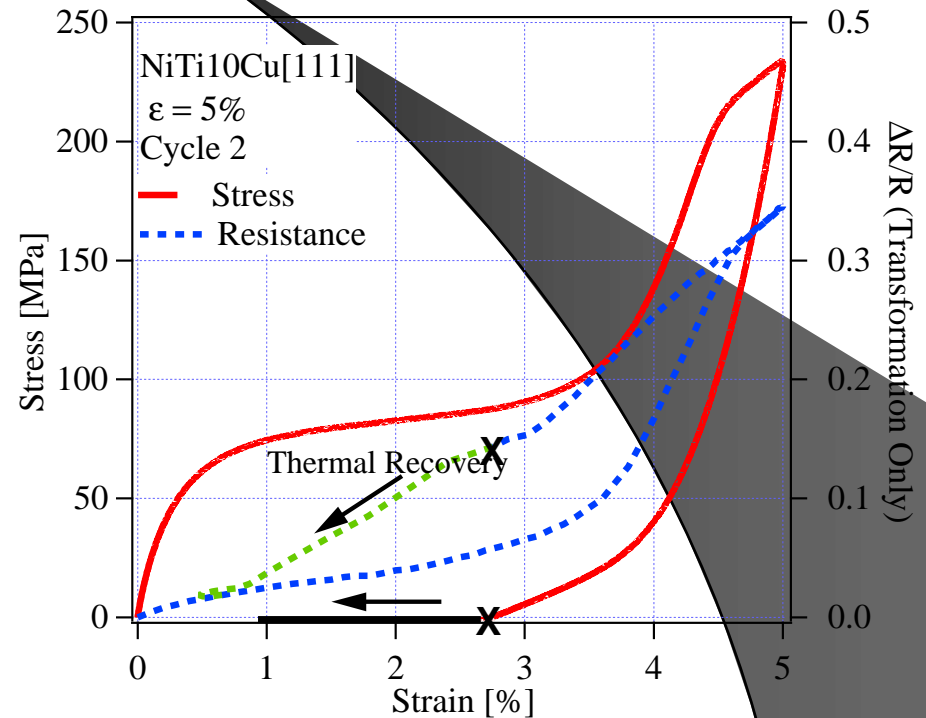
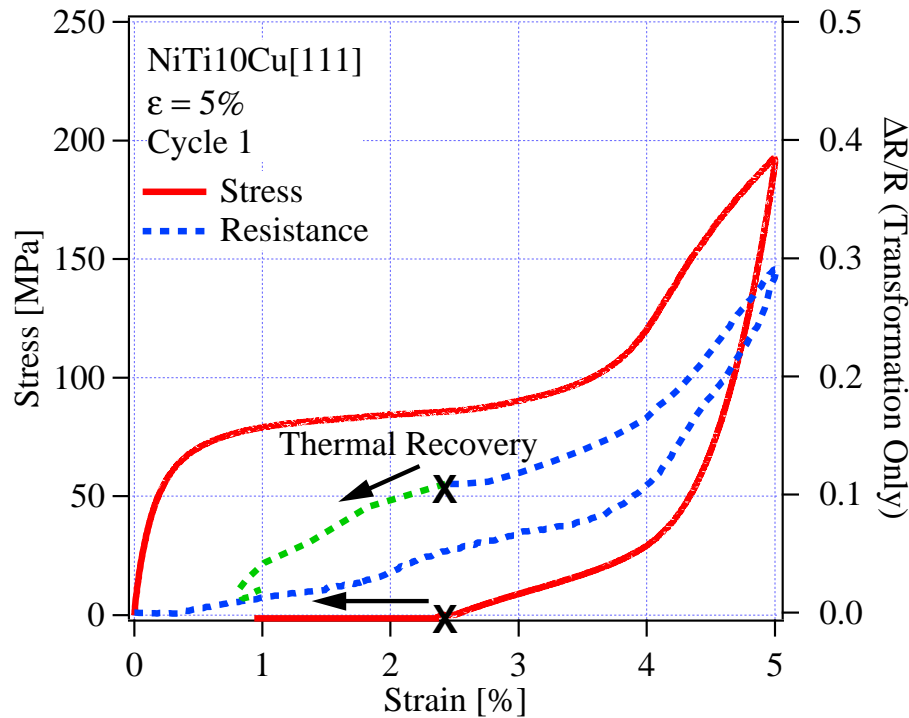
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(NiTi Shape Memory Material)



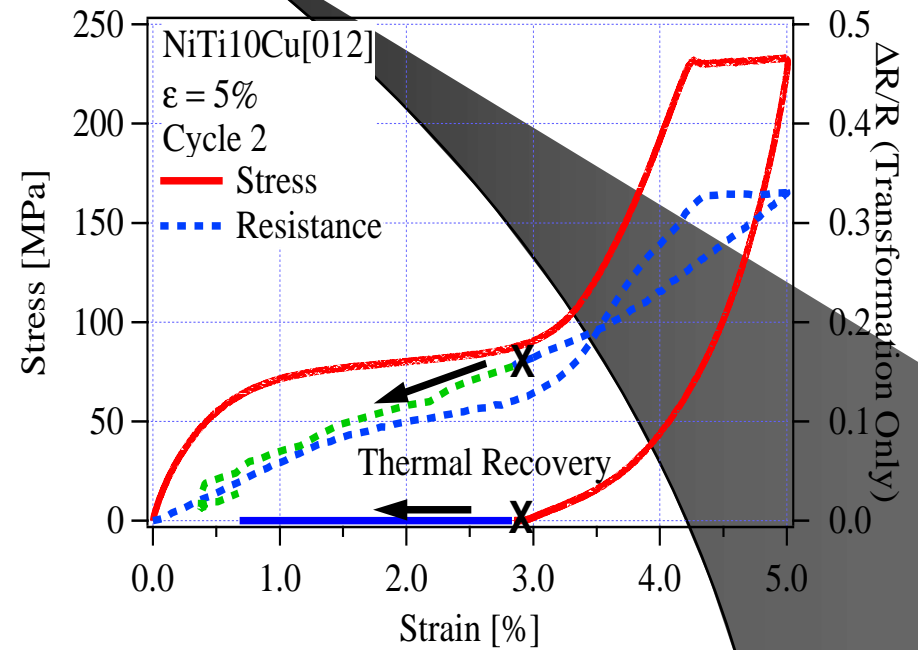
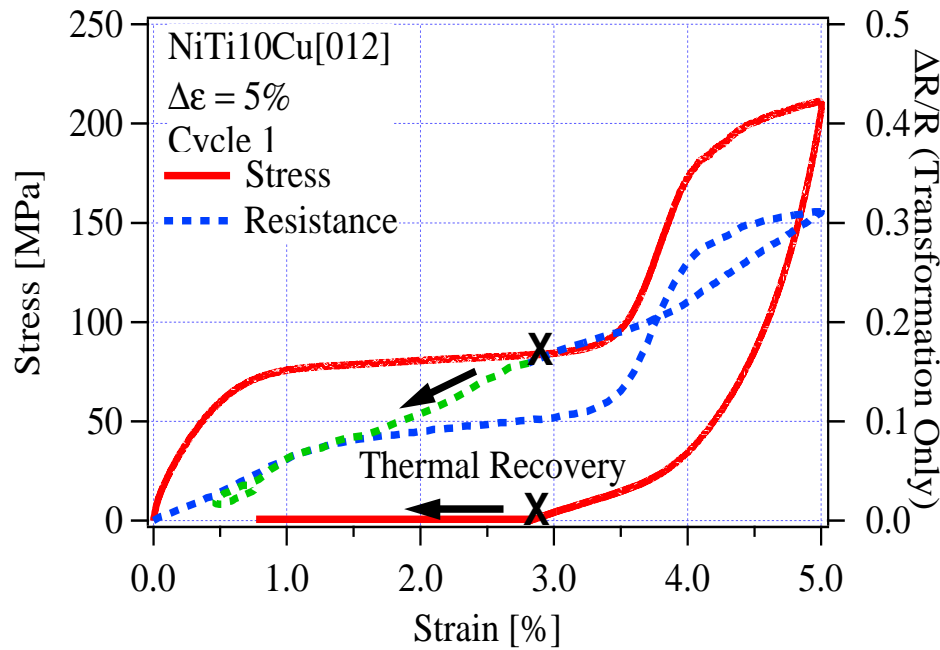
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(NiTi10Cu Shape Memory Material)



# Monotonic Tensile Loading

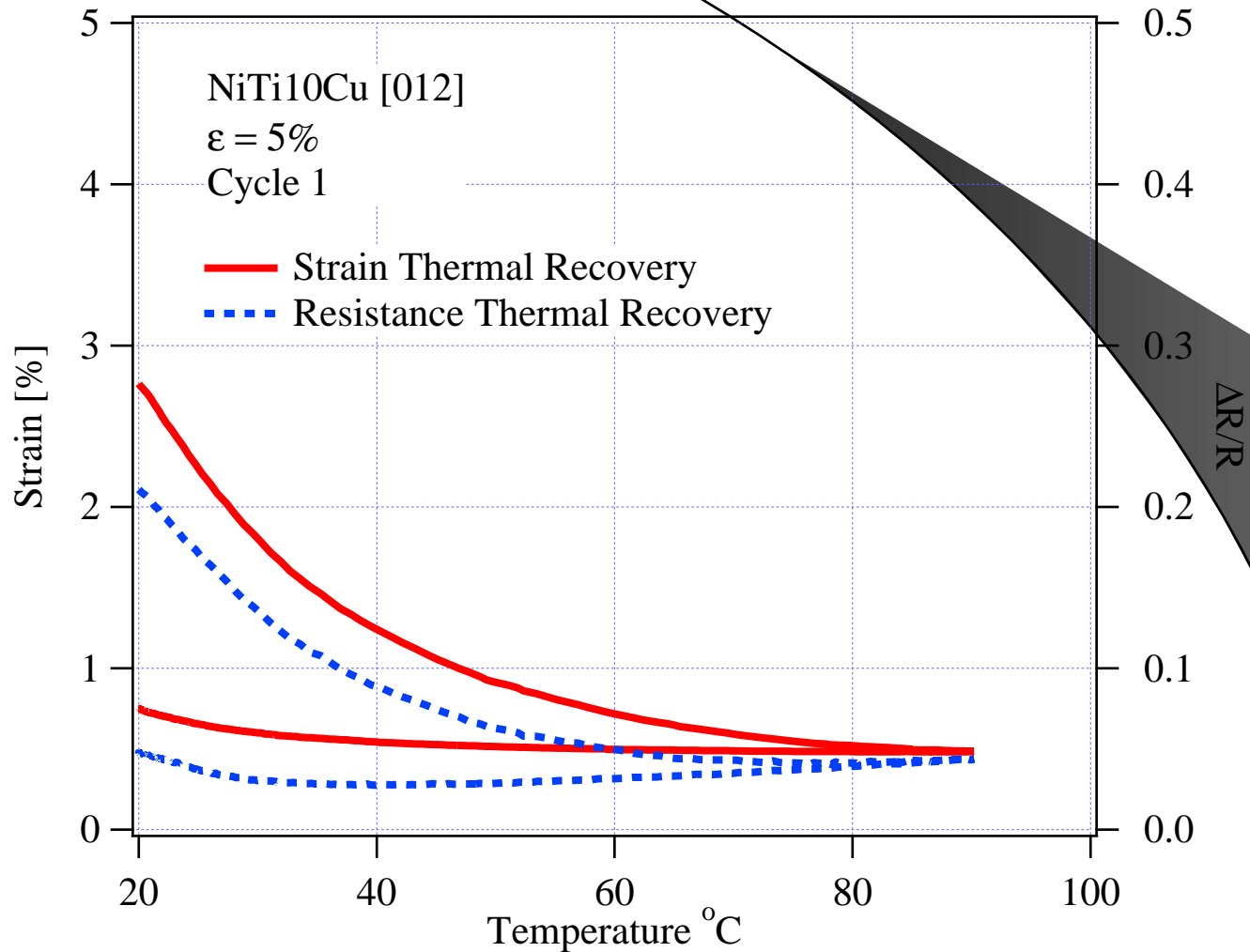
(NiTi10Cu Shape Memory Material)





# Thermal Recovery

(NiTi10Cu Shape Memory Material)



# Conclusions

- Variation of the electrical resistance is a good indication of the transformation.
- Resistance change due to the elasto-plastic deformation is much smaller than the transformation.
- Electrical resistance is a better representation of the transformation than the strain.
- A good relation is obtained between the amount of transformation and resistance change during thermal cycle loading.
- Two-stage transformation is observed during monotonic tensile loading but single stage during unloading period.