



## Study in Phase-Transformation Temperature in Nitinol by In Situ TEM Heating

Yang, Y.-C.; Bastos da Silva Fanta, A.; Jinschek, J.; Popovich, V.; Zhu, J.

*Publication date:*  
2023

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Yang, Y.-C., Bastos da Silva Fanta, A., Jinschek, J., Popovich, V., & Zhu, J. (2023). *Study in Phase-Transformation Temperature in Nitinol by In Situ TEM Heating*. Abstract from FEMS EUROMAT 2023, Frankfurt am Main, Germany.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## **Study in Phase-Transformation Temperature in Nitinol by In Situ TEM Heating**

Yang, Y.-C.<sup>1</sup>; Bastos da Silva Fanta, A.<sup>1</sup>; Jinschek, J.<sup>1</sup>; Popovich, V.<sup>2</sup>; Zhu, J.<sup>2</sup>

<sup>1</sup>Danmarks Tekniske Universitet, Lyngby (Denmark);

<sup>2</sup>Technische Universiteit Delft

Shape memory alloys (SMAs) are widely used in several applications, such as actuators, sensors and dampers, due to their attractive property of shape alloy effects (SME). SME is a capability of SMAs to regain the original shape after loading deformation by heating through the reversible martensitic transformation to nullify the strain. According to the stress-strain curve for the SMAs, the applied strain and the working temperature are used to determine the stress of the SMA and its phase. Controlling the structural transformation window by varying the different components or manufacturing can be used to achieve better performance in SMAs. As a result, an in-depth understanding of the correlation between the structural variation and the applied temperature can provide insights to improve SMAs material designs.

To capture this microstructural variation on heating in real-time, in situ heating experiments in transmission electron microscopy (TEM) are used to study the SME in laser powder bed fusion (L-PBF)-NiTi alloys. In the present study, TEM samples from different areas of melt pool were prepared by focused ion beam (FIB) and placed on the MEMS-based microheaters for in-situ TEM heating experiments to study the phase transformation with increasing temperature.

In LPBF, since the laser processing introduces the inhomogeneous heating profile at each point, this creates the melt pool with non-uniform composition distribution perpendicular to the build direction. To explore the influences of the inhomogeneous distribution on the phase transformation window, the reversible martensitic transformation has been investigated on different positions of the melt pool in in-situ TEM heating experiments. Studying microstructural transformation in heating experiments provides essential insights to further optimize process parameters in (additive) manufacturing.