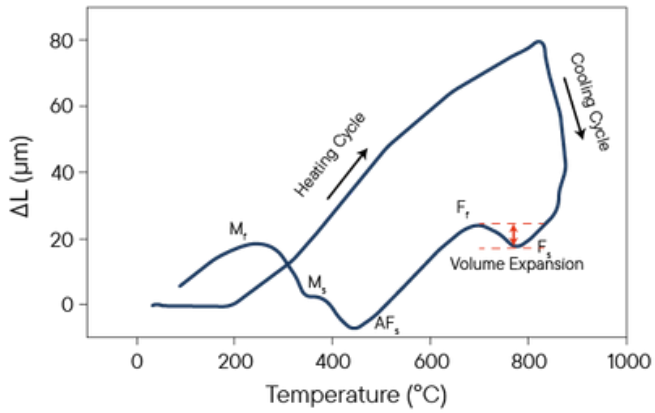
Phase Transformations in Martensitic Stainless Steel

DIL L75 Vertical Analysis of Post-Weld Heat Treatment

Phase transformations during heat treatment significantly influence the microstructure and mechanical properties of martensitic stainless steels. In this study, dilatometric measurements were performed using a LINSEIS DIL L75 Vertical to investigate the phase transformation behavior during simulated post-weld heat treatment. The results provide valuable insight into microstructural evolution and support the optimization of industrial heat treatment processes.

Measurement Setup

- Instrument: LINSEIS DIL L75 Vertical
- Material: 12Cr–1Mo Martensitic Stainless Steel
- Temperature: Up to 860 °C
- Atmosphere: Argon
- Heating/Cooling: Controlled PWHT Cycle
- Application: Post-Weld Heat Treatment Analysis



The dilatometric measurement reveals distinct phase transformations during the simulated post-weld heat treatment.
Key observations include:

- Austenite formation during heating
- Martensitic transformation during cooling
- Formation of acicular ferrite
- Characteristic dimensional changes throughout the thermal cycle

The results demonstrate the capability of dilatometry to monitor phase transformations and heat treatment behavior in martensitic stainless steels.

Interpretation

The observed behavior can be attributed to:

- Austenite reversion during heating
- Martensitic transformation during cooling
- Acicular ferrite formation
- Phase-dependent dimensional changes

This results in:

- Reliable transformation temperatures
- Improved heat treatment control
- Enhanced microstructural characterization

Industrial Relevance

Dilatometric measurements with the LINSEIS DIL L75 Vertical support:

- Post-weld heat treatment optimization
- Phase transformation analysis
- Welding metallurgy
- Heat treatment development
- High-temperature alloys
- Power generation materials

Conclusion

The LINSEIS DIL L75 Vertical enables precise characterization of phase transformations during post-weld heat treatment of martensitic stainless steels. Understanding dimensional changes throughout the thermal cycle is essential for optimizing heat treatment processes and improving the performance of welded high-temperature components.

Source:
Alcantar-Mondragon, N., Reyes-Calderon, F., García-García, V., Vázquez-Gómez, O., Salgado-López, J.
Effect of PWHT on the Dissolution of δ-Ferrite in the Welded Joint of 12Cr–1Mo Steels for Steam Turbines.
Journal of Materials Research and Technology, 2021.
Adapted from dilatometric phase transformation measurements performed using a LINSEIS DIL L75 Vertical.