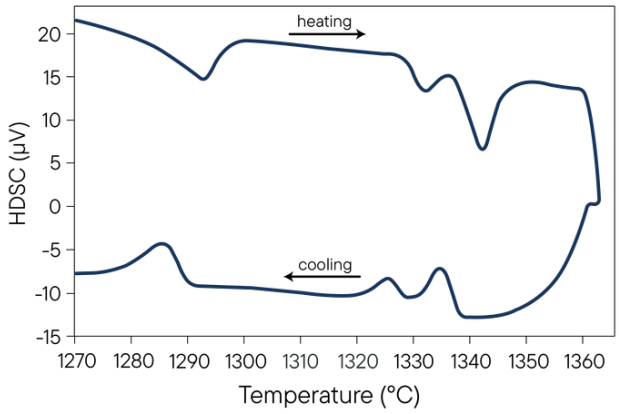
High-Temperature Phase Transformation Analysis

STA L81 Investigation of Phase Transitions in Y–Ni Alloys

Understanding high-temperature phase transformations is essential for developing advanced intermetallic materials and refining phase diagrams. Simultaneous Thermal Analysis enables the precise determination of transformation temperatures and reaction mechanisms during heating and cooling. In this study, a LINSEIS STA L81 was used to investigate phase transitions in Y–Ni alloys. The results provide valuable insight into peritectic and metatectic reactions occurring at elevated temperatures.

Measurement Setup

- Instrument: LINSEIS STA L81
- Material: $Y_{20}Ni_{80}$ Alloy
- Temperature Range: Room Temperature to 1360 °C
- Atmosphere: Argon
- Measurement: Differential Thermal Analysis (DTA)
- Application: Phase Diagram Investigation



The DTA measurement reveals distinct thermal events associated with phase transformations in the Y–Ni alloy.

Key observations include:

- Well-defined thermal peaks during heating and cooling
- Identification of peritectic and metatectic reactions
- Narrow stability range of the ~YNi_4 phase
- Reliable determination of transformation temperatures

The results demonstrate the capability of simultaneous thermal analysis for high-temperature phase transformation studies.

Interpretation

The observed behavior can be attributed to:

- Formation of the ~YNi_4 phase
- Peritectic and metatectic reactions
- Temperature-dependent phase stability
- Reversible thermal transformations

This results in:

- Accurate transformation temperatures
- Improved phase diagram evaluation
- Reliable alloy characterization

Industrial Relevance

Simultaneous Thermal Analysis measurements support:

- Phase diagram development
- Intermetallic alloy research
- High-temperature materials
- Alloy design and optimization
- Metallurgical process development
- Materials science research

Conclusion

The LINSEIS STA L81 enables precise characterization of high-temperature phase transformations in intermetallic alloys. Accurate determination of transformation temperatures and reaction mechanisms provides valuable information for phase diagram refinement and the development of advanced high-temperature materials.

Source:
Babizhetskyy, V., Myakush, O., Levytskyi, V., Kotur, B., Duppel, V., Kienle, L.
On the Binary Phases ~YNi_4 and Y_2Ni_7.
Chemistry of Metals and Alloys, 2018, 11, 92–99.
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Adapted from differential thermal analysis (DTA) measurements performed using a LINSEIS STA PT 1600 (current designation: STA L81).