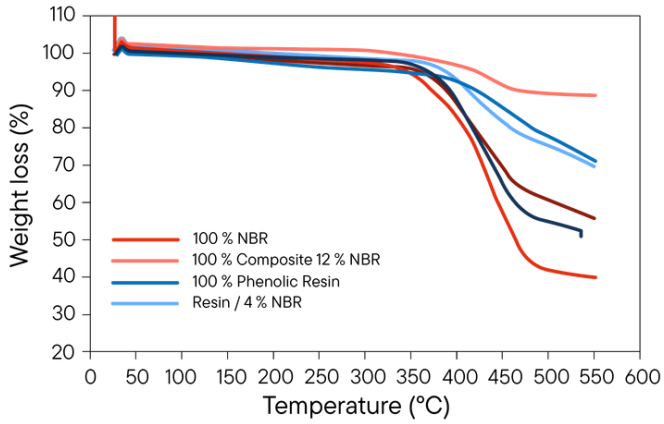
Thermal Stability of Composite Materials for Lightweight Engineering

Thermogravimetric Analysis of NBR-Modified Composite Materials

Thermogravimetric Analysis (TGA) enables the investigation of thermal stability and decomposition behavior under controlled heating conditions. In this application example, composite friction materials with different nitrile butadiene rubber (NBR) contents were analyzed to evaluate their thermal degradation characteristics and high-temperature performance.

Measurement Setup

- Instrument: Linseis STA L81 (former designation: STA PT 1600)
- Sample: NBR-modified composite friction materials
- Temperature range: Room temperature to 550 °C
- Heating rate: 20 °C/min
- Atmosphere: Nitrogen (60 ml/min)
- Measurement: Thermogravimetric Analysis (TGA)
- Application: Lightweight composite and high-performance materials



The TGA measurement reveals the thermal degradation behavior of the investigated composite materials.
Key observations include:

- Distinct thermal stability differences between material formulations
- Onset of mass loss around 370–390 °C
- Improved high-temperature behavior of composite formulations
- Characteristic decomposition profiles depending on NBR content

The results demonstrate the suitability of TGA for evaluating the thermal stability of lightweight composite materials.

Interpretation

The observed thermal behavior can be attributed to:

- Polymer decomposition processes
- Cross-linking effects within the resin system
- Material composition and NBR content

This results in:

- Improved understanding of thermal stability
- Better material selection for high-temperature applications
- Optimized lightweight composite design

Industrial Relevance

TGA measurements are widely used for:

- Lightweight material development
- Composite material characterization
- Thermal stability evaluation
- High-temperature component design
- Automotive and aerospace applications
- Quality assurance and material optimization

Conclusion

The measurement performed with the Linseis STA L81 demonstrates the suitability of thermogravimetric analysis for evaluating the thermal stability of advanced composite materials. The obtained data support material selection and optimization for lightweight engineering applications requiring reliable high-temperature performance.

Source:
Surojo, E., Ariawan, D., Arsada, R., Muhayat, N., Raharjo, W.W., Smaradhana, D.F.
Effect of Nitrile Butadiene Rubber (NBR) on Mechanical and Tribological Properties of Composite Friction Brakes.
Tribology in Industry, Vol. 41, No. 4, 2019, pp. 516–525.
Adapted from thermogravimetric measurements performed using a Linseis STA L81 (former designation: STA PT 1600).