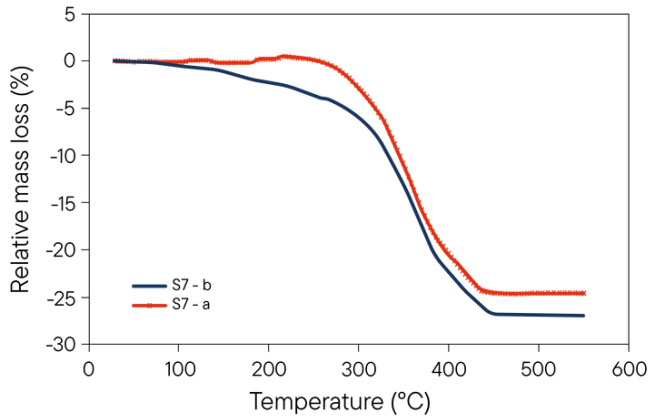
Thermal Degradation of Photocured Calcium Phosphate Suspensions

TGA L83 Characterization of Binder Burnout for Ceramic Additive Manufacturing

Thermogravimetric analysis is an essential tool for optimizing debinding processes in ceramic additive manufacturing. Precise determination of polymer decomposition enables defect-free binder removal and improves the quality of sintered ceramic components. In this study, a LINSEIS TGA L83 was used to investigate the thermal degradation behavior of photocured calcium phosphate suspensions for stereolithography.

Measurement Setup

- Instrument: LINSEIS TGA L83
- Material: Photocured β-Tricalcium Phosphate Suspension
- Temperature Range: 25 °C to 550 °C
- Atmosphere: Air
- Heating Rate: 10 °C/min
- Measurement: Thermogravimetric Analysis (TGA)
- Application: Binder Burnout Optimization for SLA Ceramics



The TGA measurements reveal the influence of curing conditions on the thermal degradation of the polymer network.

Key observations include:

- Stable mass below approximately 250 °C for high curing energy
- Earlier degradation with reduced LED power
- Major binder removal between 300 °C and 450 °C
- Comparable final residual mass after complete decomposition

The measurements provide the basis for designing optimized debinding cycles for ceramic stereolithography.

Interpretation

The observed behavior can be attributed to:

- Different polymer crosslink densities
- Influence of curing energy
- Progressive polymer decomposition
- Temperature-dependent binder burnout

This results in:

- Optimized debinding profiles
- Reduced crack formation
- Improved ceramic part quality

Industrial Relevance

Thermogravimetric analysis supports:

- Ceramic additive manufacturing
- Binder burnout optimization
- SLA process development
- Biomedical ceramics
- Process qualification
- Advanced ceramic production

Conclusion

The LINSEIS TGA L83 provides precise characterization of binder decomposition and thermal stability in photocured ceramic suspensions. These measurements enable optimized debinding strategies, helping to reduce defects and improve the quality and reliability of additively manufactured ceramic components.

Source:
Goutagny, C., Hocquet, S., Hautcoeur, D. et al.
Development of Calcium Phosphate Suspensions Suitable for the Stereolithography Process.
Open Ceramics, 2021.
Adapted from thermogravimetric measurements performed using a LINSEIS TGA L83.