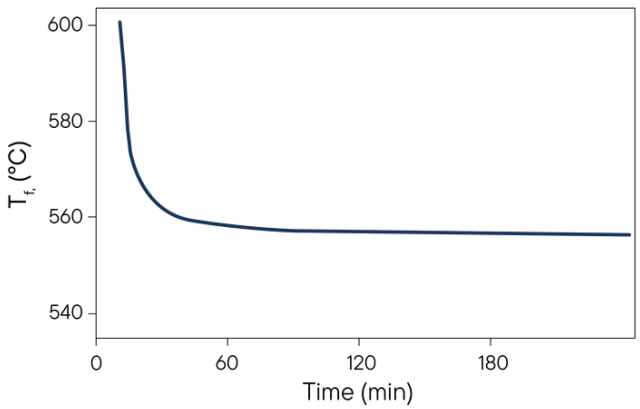
Thermoviscoelastic Characterization of Optical Glass

DIL L75 Horizontal Analysis of Creep Behavior in Non-Isothermal Glass Molding

The thermoviscoelastic behavior of glass plays a critical role in precision glass molding processes. Accurate characterization of time-dependent deformation is essential for predicting dimensional stability and minimizing residual stresses in optical components. In this study, creep measurements on N-BK7 optical glass were performed using a LINSEIS DIL L75 Horizontal to investigate deformation behavior within the glass transition range. The results provide valuable input data for modeling and optimizing advanced glass molding processes.

Measurement Setup

- Instrument: LINSEIS DIL L75 Horizontal
- Material: N-BK7 Optical Glass
- Temperature Range: 540 °C to 580 °C
- Applied Load: Constant Mechanical Force
- Measurement: Creep Deformation Analysis
- Application: Precision Glass Molding



The dilatometric creep measurement reveals a strong temperature dependence of glass deformation.

Key observations include:

- Creep deformation increases with temperature
- Lowest deformation at 540 °C
- Significant increase above 560 °C
- Stable and reproducible measurement results
- Valuable input for glass molding simulations

The results demonstrate the suitability of dilatometry for characterizing glass deformation behavior and optimizing non-isothermal molding processes.

Interpretation

The observed behavior can be attributed to:

- Reduced glass viscosity at elevated temperatures
- Increased molecular mobility near Tg
- Enhanced viscoelastic deformation under load
- Temperature-dependent material response

This results in:

- Improved process understanding
- Optimized molding conditions
- More accurate simulation models

Industrial Relevance

Dilatometry measurements support:

- Precision glass molding
- Optical lens manufacturing
- Infrared optics production
- Consumer electronics optics
- Automotive and sensor applications

Conclusion

The LINSEIS DIL L75 Horizontal enables precise characterization of temperature-dependent creep behavior under molding-relevant conditions. Understanding the thermoviscoelastic response of glass is essential for predicting deformation during processing and improving simulation models. These insights support the optimization of non-isothermal glass molding processes and the production of high-precision optical components.

Source:
Vu, A. T., Avila Hernandez, R. A., Grunwald, T., Bergs, T.
Modeling nonequilibrium thermoviscoelastic material behaviors of glass in nonisothermal glass molding.
Journal of the American Ceramic Society, 2022, 105(11), 6799–6815.
DOI: 10.1111/jace.18605
Adapted from dilatometric measurements performed using a LINSEIS DIL L75H (current designation: DIL L75 Horizontal).