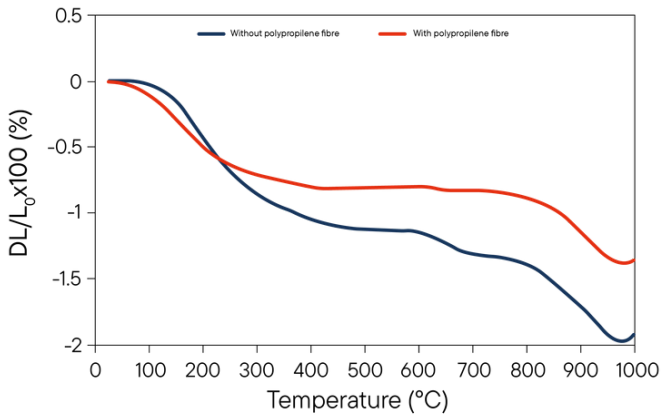
Thermal Shrinkage Characterization of Fire-Resistant Plasters

DIL L75 Horizontal Analysis of Thermal Dimensional Stability in Alkali-Activated Slag Plasters

The dimensional stability of fire-resistant construction materials plays a critical role in maintaining structural integrity during fire exposure. Accurate characterization of thermal shrinkage is essential for understanding high-temperature behavior and optimizing protective plaster formulations. In this study, dilatometric measurements were performed using a LINSEIS DIL L75 Horizontal to investigate the thermal shrinkage behavior of alkali-activated slag plasters with and without polypropylene fibres. The results provide valuable insight into dimensional stability and support the development of advanced passive fire protection materials.

Measurement Setup

- Instrument: LINSEIS DIL L75 Horizontal
- Material: Alkali-Activated Slag Plaster
- Temperature Range: Room Temperature to 1000 °C
- Measurement: Relative Linear Shrinkage
- Application: Fire-Resistant Building Materials



The dilatometric analysis reveals clear differences in the thermal shrinkage behavior of the investigated plaster formulations.
Key observations include:

- Continuous shrinkage throughout heating
- Lower final shrinkage with polypropylene fibres
- Improved dimensional stability up to 1000 °C
- Reduced deformation during thermal exposure

The results demonstrate the effectiveness of fibre reinforcement in improving the high-temperature stability of alkali-activated plasters.

Interpretation

The observed behavior can be attributed to:

- Controlled release of water vapour
- Formation of micro-channels by melting fibres
- Reduced internal pressure during heating
- Improved dimensional stability

This results in:

- Lower thermal shrinkage
- Enhanced fire resistance
- Increased structural integrity

Industrial Relevance

Dilatometry measurements support:

- Fire-resistant plasters
- Passive fire protection systems
- Sustainable construction materials
- Alkali-activated binders
- High-temperature material development
- Building material research

Conclusion

The LINSEIS DIL L75 Horizontal enables precise characterization of thermal shrinkage in advanced construction materials. Understanding the dimensional stability of alkali-activated slag plasters under high-temperature conditions is essential for optimizing fire-resistant coatings and passive fire protection systems. These insights support the development of durable and sustainable building materials with improved thermal performance.

Source:
Kielė, A., Vaičiukynienė, D., Tamošaitis, G., Bistrickaitė, R.
Thermal Properties of Alkali Activated Slag Plaster for Wooden Structures.
Scientific Reports, 2020.
Adapted from thermal shrinkage measurements performed using a LINSEIS DIL L75 Horizontal (formerly designated as LH75 PT1600).