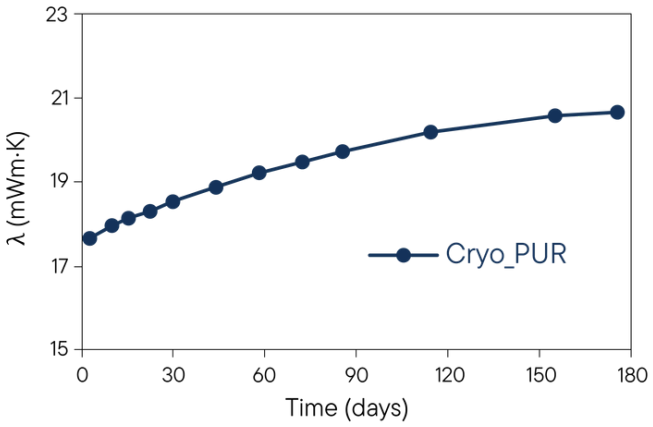
Thermal Conductivity Stability of Cryogenic Polyurethane Foams During Long-Term Storage

Long-term Heat Flow Meter Analysis of Cryogenic PUR Insulation Materials

Heat Flow Meter (HFM) analysis enables the precise determination of thermal conductivity under controlled conditions. In this application example, the long-term thermal insulation performance of cryogenic polyurethane foams was investigated using the former HFM 200, now the Linseis HFM L57 200. The measurement provides valuable insights into ageing behavior and long-term thermal performance for cryogenic applications.

Measurement Setup

- Instrument: Linseis HFM L57 200 (former designation: HFM 200)
- Sample: Cryo_PUR rigid polyurethane foam
- Top plate temperature: 20 °C
- Bottom plate temperature: 0 °C
- Measurement: Thermal conductivity (λ10)
- Application: Cryogenic insulation materials



The HFM measurement reveals the long-term thermal conductivity behavior of the investigated Cryo_PUR insulation material.
Key observations include:

- Low initial thermal conductivity
- Gradual increase during long-term storage
- Stable thermal insulation performance
- Excellent suitability for cryogenic applications

The results demonstrate the long-term reliability of the investigated insulation material.

Interpretation

The observed increase in thermal conductivity can be attributed to:

- Gas diffusion within the foam structure
- Natural ageing processes
- Long-term material stabilization

This results in:

- Reliable insulation performance
- Stable long-term properties
- High suitability for cryogenic environments

Industrial Relevance

HFM measurements are widely used for:

- Cryogenic insulation development
- Space launcher technologies
- LNG storage and transport
- Thermal insulation qualification
- Long-term ageing studies
- Quality assurance of insulation materials

Conclusion

The measurement performed with the Linseis HFM L57 200 demonstrates the suitability of Heat Flow Meter analysis for evaluating the long-term thermal performance of cryogenic polyurethane insulation materials. The results provide valuable insights into ageing behavior and thermal conductivity stability, supporting the development of reliable insulation systems for demanding cryogenic applications.

Source:
Cabulis, U., Yakushin, V., Fischer, W. P. P., Rundans, M., Sevastyanova, I., Deme, L.
Rigid Polyurethane Foams as External Tank Cryogenic Insulation for Space Launchers.
IOP Conference Series: Materials Science and Engineering, Vol. 500, 2019.
Adapted from measurements performed using a Linseis HFM L57 200 (former designation: HFM 200) Heat Flow Meter.