# Novel PP liner materials for giga-scale thermal energy storages

LIT Factory

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## Introduction

- Large thermal energy storages are essential for energy systems based on renewables
- Operation temperature level is increasing up to 90°C
- Development of new polyolefin liner materials with improved ageing resistance at increased temperatures

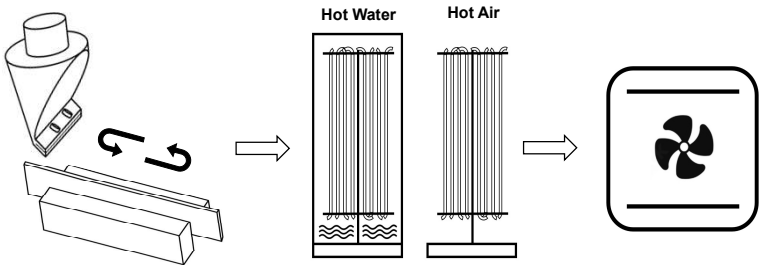
## Experimental

### Materials & Specimen preparation

- Polyolefin grades:
  - PE-HD (commercial liner material)
  - PP-HTR (with tailored stabilization package)
- Extruded 2 mm sheets
- CNC controlled cutting with a home built planing tool
- Thickness ranging from 50 to 2000 µm

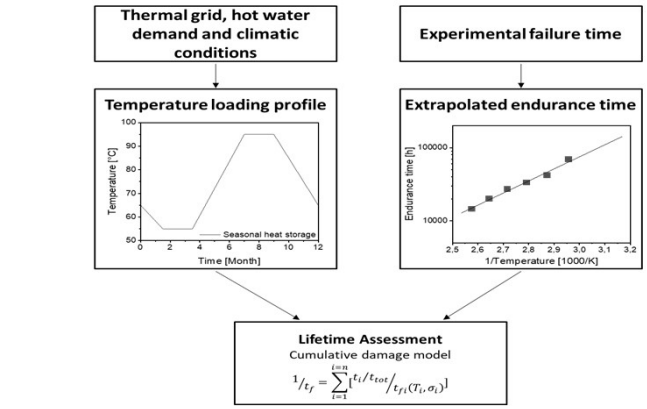
### Ageing conditions

- Accelerated at 95, 105 and 115°C
- Environment:
  - hot water
  - hot air
- exposure time up to 50.000 hours (ongoing)




## Conclusions

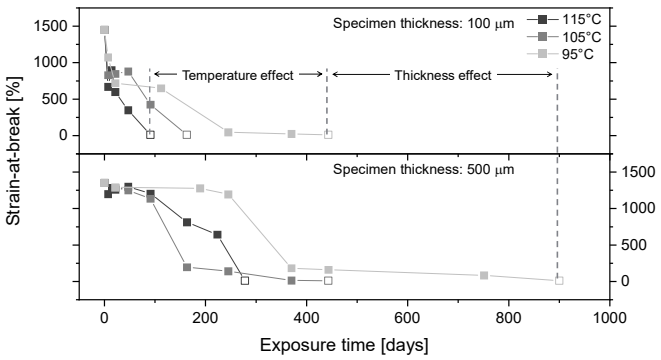
- Implementation of a testing method for efficient screening based on micro-sized specimen
- Novel PP-HTR materials (based an well-established hot water pipe grades) allow for significant improvement of durability




## Results

### Endurance time

- While hot water is more critical for PE-HD, hot air has a higher impact on PP-HTR
- Acceleration factors:
  - temperature effect: 3 to 5x (↑20°C)
  - thickness effect: 5 to 20x (from 50 to 2000 µm)




| Predicted Lifetime [years] | | |
|---|---|---|
| | **Buffer Storage 90°C** | **Seasonal Storage 50 – 90°C** |
| PE-HD | 6.5 | 17 |
| PP-HTR | 25 | 47 |

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