Bench Scale Fire Resistance Test of Materials for Housings of Rechargeable Energy Storage System (REESS)

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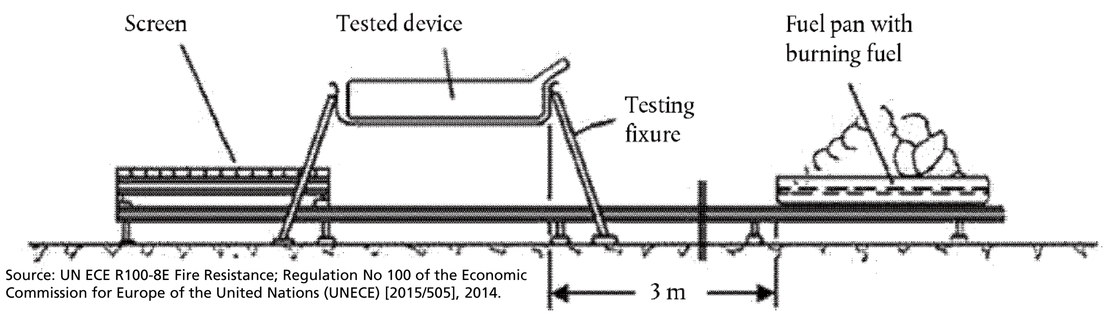
Introduction

The resistance of a REESS against exposure to a fuel fire has to be tested according to UN ECE Regulation No. 100 part 8E. However, this test is not applicable within the material and process development state due to the high material demand and production costs of the REESS. Standard tests like e.g. LOI, UL94-V or cone calorimetry are not sufficient.
The poster describes a new bench scale test setup and first results.

UNECE R100-8E Test Setup



Source: UN ECE R100-8E Fire Resistance; Regulation No 100 of the Economic Commission for Europe of the United Nations (UNECE) [2015/505], 2014.

- Verify the resistance of REESS against exposure to fire from outside of the vehicle (fuel spill from a vehicle)
- Test applied on vehicle or REESS including cells and electrical connections
- 70 s direct flame treatment then 60 s indirect flame treatment
- Observation time after test: 2 - 3 hours
- Test criteria: no evidence of explosion

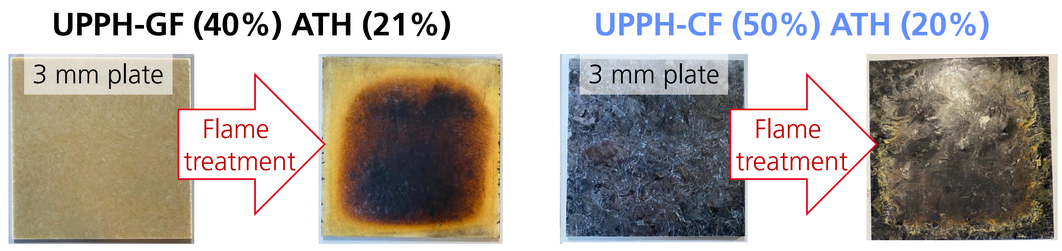
Setup of Bench Scale Fuel Fire Test

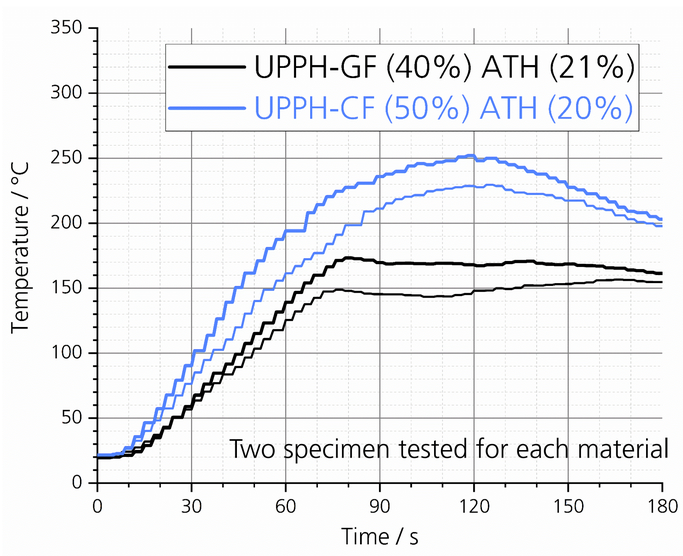
Setup
- Test specimen: 190 x 190 mm²
- Test specimen fixed in a metal frame
- Flame treatment: 100 - 130 s
- Fuel: commercial petrol
- Distance fuel pan to specimen: 300 mm
- Video recording of the flame exposed specimen side
- Temperature recording of the specimen backside

Test Criteria

- Self-extinction
- Ignition of the specimen back side
- Structural integrity (note: no mechanical stress is applied by the test setup)
- Mass loss
- Temperature of the specimen back side: < 80 °C

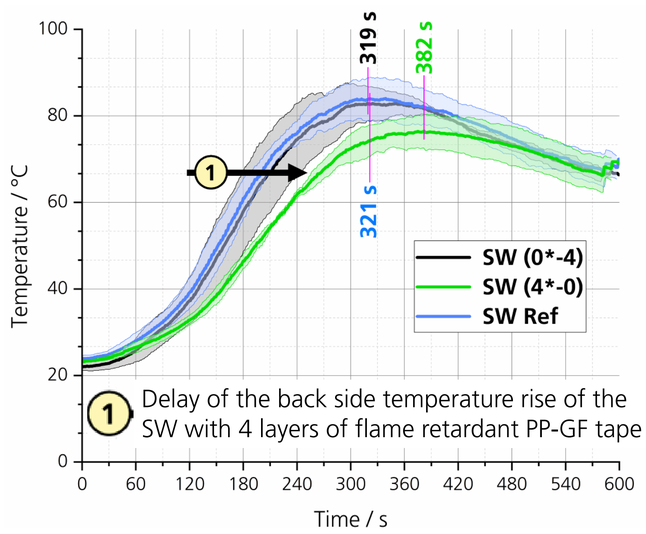
First Results
UPPH - Unsaturated polyester-polyurethane hybrid resin





- **Self-extinction:** yes
- **Back side ignition:** no
- **Struct. integrity:** remains
- **Mass loss:**
  - UPPH-GF: 1.8 ± 0.20 %
  - UPPH-CF: 0.9 ± 0.36 %

PP-GF-EPP Sandwich (SW)



* PP-GF tape containing 31% $Mg(OH)_2$

#	Mass loss / %	$T_{max, back side}$ / °C	t of T_{max} / s
SW (0*-4) a	5.6	80.2	357
SW (0*-4) b	5.9	86.8	315
SW (0*-4) c	6.1	83.4	323
∅	**5.9**	**83.5**	**332**
SW (4*-0) a	4.5	80.3	383
SW (4*-0) b	4.7	72.7	375
SW (4*-0) c	4.7	76.8	389
∅	**4.6**	**76.6**	**382**
SW Ref a	4.4	88.0	338
SW Ref b	4.5	85.8	325
SW Ref c	4.5	78.8	308
∅	**4.5**	**84.2**	**324**

- **Self-extinction:** yes
- **Back side ignition:** no
- **Struct. integrity:** remains

Conclusions

The bench scale fuel fire test for the UNECE R100-8E test is a cost efficient pre-evaluation method for developing materials and manufacturing processes for REESS housings. Verification and further improvements are in progress.

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Further information:
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