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DEPARTMENT OF FIRE-SAFE SUSTAINABLE BUILT ENVIRONMENT

Fire Laboratory and Fire Engineering

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Member of egolf - European Group of Organisations for Fire Testing, Inspection and Certifications

TEST REPORT
92/24–530–1–EN–R1

Testing of reaction to fire based on standard
ISO 5660-1:2015, ISO 5660-1:2015/Amd 1:2019
for product: aged coated impregnated spruce wood
SiOO:X - Spruce

Orderer:	**Burnblock ApS,** **Wilders Plads 15C, DK-1403, Copenhagen, Denmark**
Order/contract:	**Interdepartment order 144/2024 dated 28. 2. 2024** **ZAG contract No. 9777/24U**
Responsible investigator:	**dr. Nataša Knez, univ. dipl. inž. el.**
Head of laboratory:	**Friderik Knez, univ. dipl. fiz.**
Director:	**doc. dr. Aleš Žnidarič, univ. dipl. inž. grad.**
Date**:**	25. 3. 2024

Digitalno podpisano:
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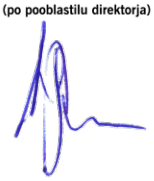

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Total number of pages: 11; total number of annexes: 2.

1. General

Product: aged coated impregnated spruce wood **SiOO:X - Spruce**

Supplier: Burnblock ApS, Wilders Plads 15C, DK-1403, Copenhagen, Denmark

Manufacturer: Burnblock ApS, Wilders Plads 15C, DK-1403, Copenhagen, Denmark

Note: The revision refers to the range of results being reported.

2. Sampling

Place: -

Date of sampling: -

Quantity of sample: 2 differently aged coated impregnated spruce wood specimens

Marking of the sample: 1 piece marked SP74, 1 piece marked SP69

Date of production: -

Sample No.: P 24/011

The sample was delivered to ZAG's Fire laboratory on 22. 1. 2024 in a mailed package. The laboratory was not involved in sampling procedure.

3. Description of the product

The product is impregnated spruce wood with a surface treatment that has been in the QUV accelerated weather tester at Danish Technical Institute.

Impregnation: autoclave (Burnblock)

Coating: SiOO:x coating, 2 layer system, grey colour (Kolomore)

Aging: according to EN 927-6 (Teknologisk Institute)

Six specimens of following dimensions were tested:

Test	Product	Thickness [mm]	Length [mm]	Width [mm]	Mass [g]	Density [kg/m^3]
1	SP 74	19.0	99.6	97.0	76.09	415
2	SP 74	18.8	98.0	97.6	85.57	476
3	SP 74	18.8	100.0	97.2	74.94	410
4	SP 69	18.8	99.8	97.3	72.73	398
5	SP 69	18.8	99.7	97.3	72.0	394
6	SP 69	18.6	99.6	97.1	77.61	431

4. Details of conditioning

The specimens were stored from 22. 1. 2024 until the day of testing under normal climate conditions at 23 °C and 50 % humidity. The mass of tested specimens achieved constant mass according to EN 13238:2010, point 4.2.

5. Construction of test specimens

Six specimens were prepared from delivered samples. The dimensions are written in the table above.

6. Test methods

ISO 5660-1:2015 Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement),
ISO 5660-1:2015/Amd 1:2019 Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement) – Amendment 1

Deviation from test standard: the test was terminated earlier; the dimensions of the test specimens were smaller due to the size of provided wood samples.

7. Date of test

30. 1. 2024

8. Test conditions

An incident heat flux of 50 kW/m^2 was applied in all of the tests.

9. Calculation of test results

The test results were processed by the ConeTools software. The software is predicting SBI test results based on cone calorimetry testing. As a result of simulation, two parameters of the EN 13823 test method, FIGRA (Fire Growth Rate) and THR (Total Heat Release) are calculated. These two parameters together with some other parameters are used for determination of classification according to EN 13501-1 based on SBI test results. The reliability of the prediction depends on several aspects related to the test specimen.

10. Test results

10.1 Results of measurement

Observation during tests:

SP 74-1: The specimen ignited after 9 seconds and went out after 21 seconds from the start of the test. Reignition occurred 236 s after the test start. Before the second ignition, flames were observed at the spark ignitor and some flashes were observed on the specimen surface.

SP 74-2: The specimen ignited after 12 seconds and went out after 29 seconds from the start of the test. Reignition occurred at 883 s and ended around 1000 s after the test start. Also, 2 to 3 minutes after the test start, small parts of the specimen were ejected from the surface.

SP 74-3: The specimen ignited after 12 seconds and went out after 20 seconds from the start of the test. Reignition occurred at 193 s and ended 494 s after the test start. The specimen ignited again at 628 s (with spart ignitor) and went out 982 s after the test start.

SP 69-1: The specimen ignited after 6 seconds and went out after 17 seconds from the start of the test. Reignition occurred at 150 s and ended 981 s after the test start. At around 34 s, small parts of specimen started to be ejected from the surface and around the 2nd minute of the testing time some flashes were observed on the specimen surface.

SP 69-2: The specimen ignited after 13 seconds and went out after 19 seconds from the start of the test. Reignition occurred at 243 s and ended 1030 s after the test start. At around 39 s small parts of specimen started to be ejected from the surface, and between 2 and 3.6 minute of the testing time, some flashes were observed on the specimen surface.

SP 69-3: The specimen ignited after 12 seconds and went out after 23 seconds from the start of the test. Reignition occurred at 384 s and ended 1030 s after the test start. At around 37 s, small parts of the specimen started to be ejected from the surface.

Results from cone calorimeter measurement:

Test	Product	1st ignition [s]	1st flameout [s]	2nd ignition [s]	2nd flameout [s]	3rd ignition [s]	3rd flameout [s]
1	SP74-1	9	21	236	1000	-	-
2	SP74-2	12	29	883	1000	-	-
3	SP74-3	12	20	193	494	628	982
4	SP69-1	6	17	150	981	-	-
5	SP69-2	13	19	243	1030	-	-
6	SP69-3	12	23	384	1030	-	-

Test	Product	THR 600 s [MJ/m^2]	THR 900 s [MJ/m^2]	TSP 600 s [m^2]	Mass loss in 1000 s [%]
1	SP74-1	18.0	38.9	1.6	57.4
2	SP74-2	8.3	15.9	2.3	53.8
3	SP74-3	13.7	33.3	2.0	54.4
4	SP69-1	20.4	39.1	1.6	60.3
5	SP69-2	18.3	38.5	1.7	63.1
6	SP69-3	17.5	41.2	2.2	59.5

10.2 Simulation of FIGRA and THR

The results from the cone calorimeter tests (ISO 5660-1) can be used for prediction of two parameters, FIGRA (fire growth rate index) and THR (total heat release), which are the base of classification for class B, C or D according to EN 13501-1 standard. These two parameters together with some other relevant parameters for classification are results of testing according to test method EN 13823 (SBI), which are together with results of testing according to EN ISO 11925-2, required for classification according to EN 13501-1.

The ConeTools output can only be used for prediction of reaction to fire classification of small samples and cannot replace required testing and classification protocol.

The input for and output from ConeTools is given in the table below:

Test	Product	Time to ignition [s]	THR* [MJ]	THR [MJ] limit value for class B[1]
1	SP74-1	9	5.28	7.5 MJ
2	SP74-2	12	2.41	
3	SP74-3	12	3.99	
4	SP69-1	6	6.15	
5	SP69-2	13	5.2	
6	SP69-3	12	4.96	

* estimated parameters using ConeTools with cone test data as input

[1] Partial classification (B, C or D) according to EN 13501-1 is based on values of two criteria from testing method EN 13823: FIGRA and THR. For class B, THR value should be less or equal to 7.5 MJ
For classification according to EN 13501-1 testing according to EN 13823 and EN ISO 11925-2 is required.

11. Intended application of the product

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Statement

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

This report is not a certificate.

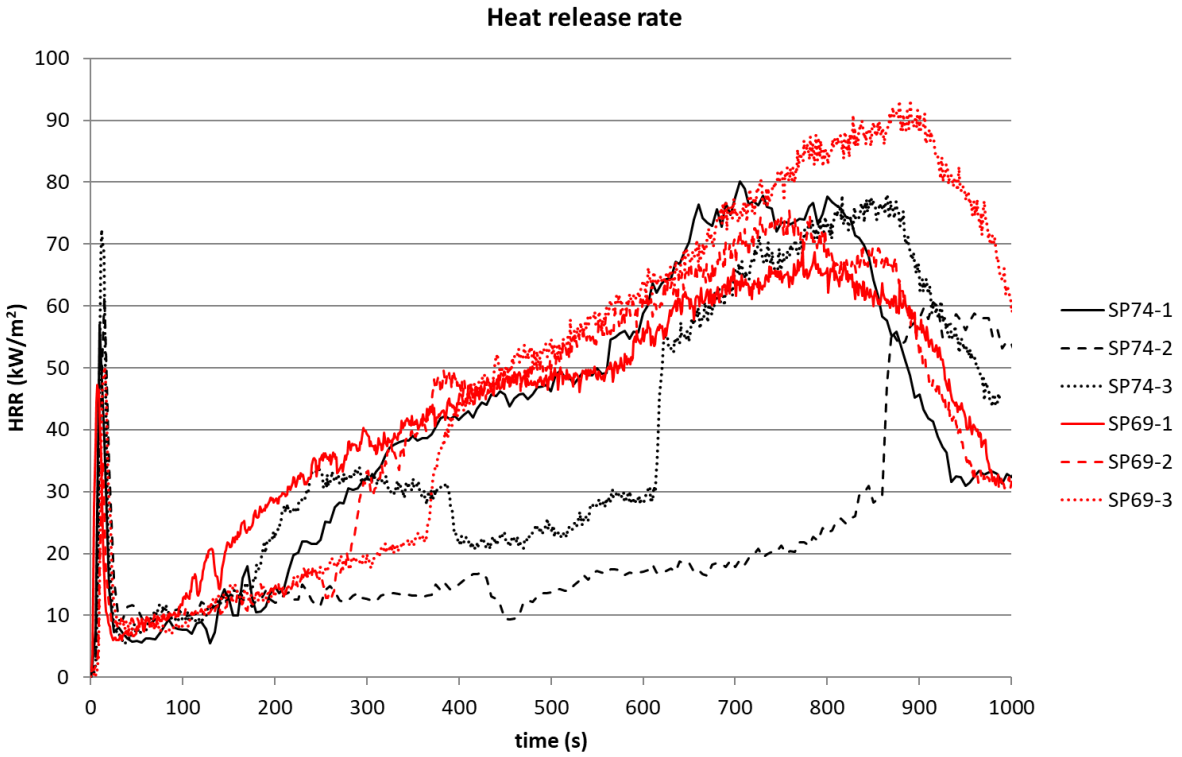
12. Annexes

Annex 1 Cone calorimeter test results (4 pages)
- Graph 1: Measured HRR (heat release rate) with cone calorimeter
- Graph 2: Measured HRR (heat release rate) with cone calorimeter, 30 s moving average
- Graph 3: Measured THR (total heat release) with cone calorimeter
- Graph 4: Measured TSP (total smoke production) with cone calorimeter
- Graph 5: Specimen mass during cone calorimeter testing
- Graph 6: Measured time to ignition with cone calorimeter
- Graph 7: Time of flaming, measured with cone calorimeter

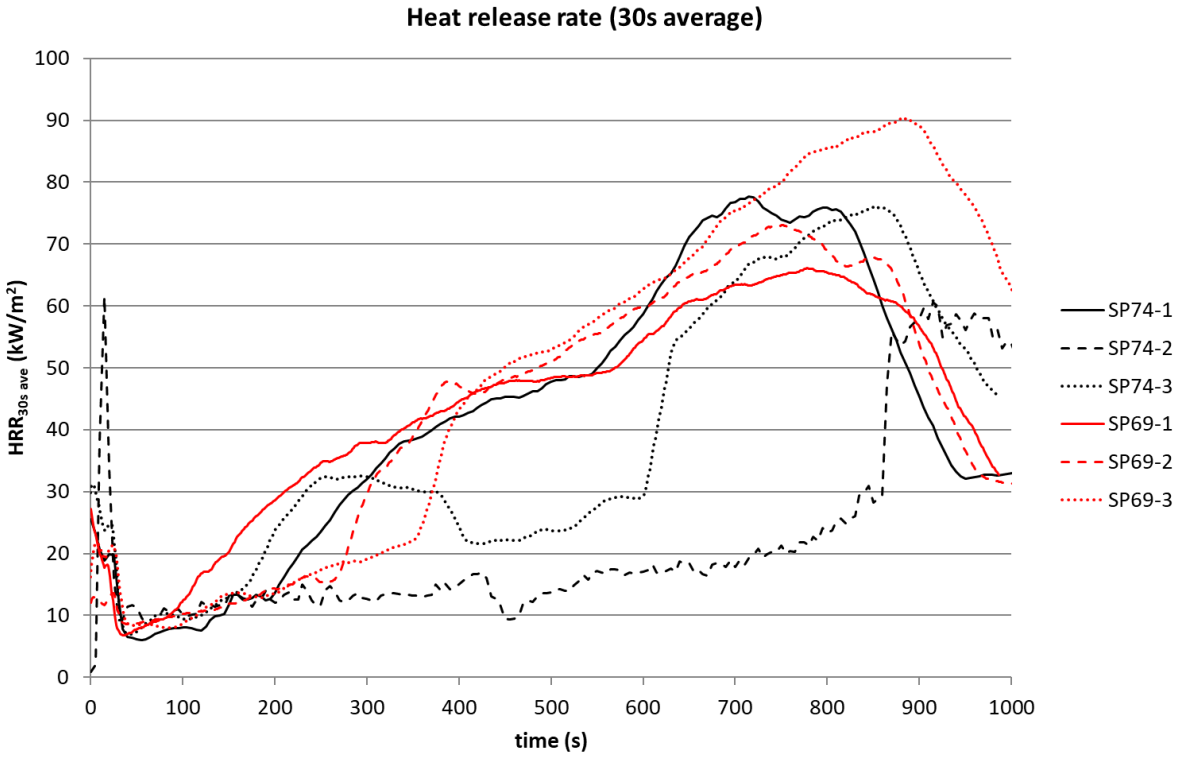
Annex 2 Estimated SBI parameters
- Graph 1: Estimated value of THR (total heat release).

The report was prepared by: dr. Nataša Knez, univ. dipl. inž. el.

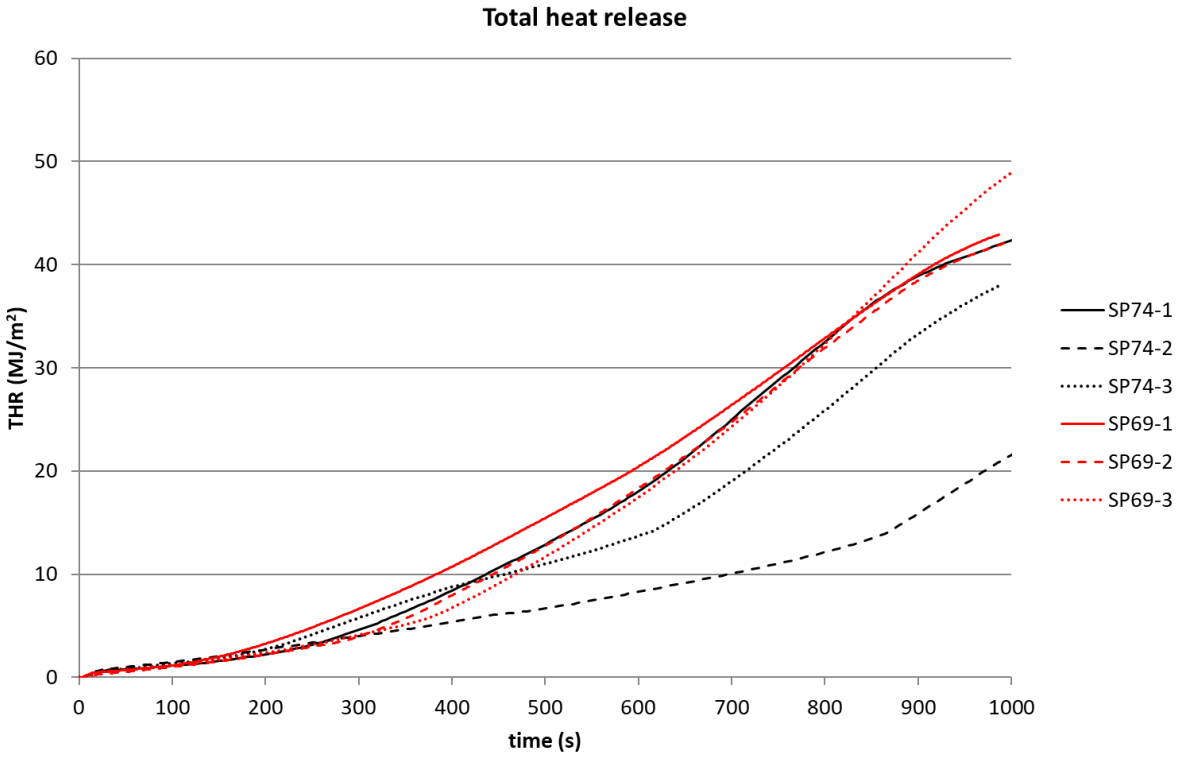
The report was reviewed and authorised by: prof. Grunde Jomaas, PhD



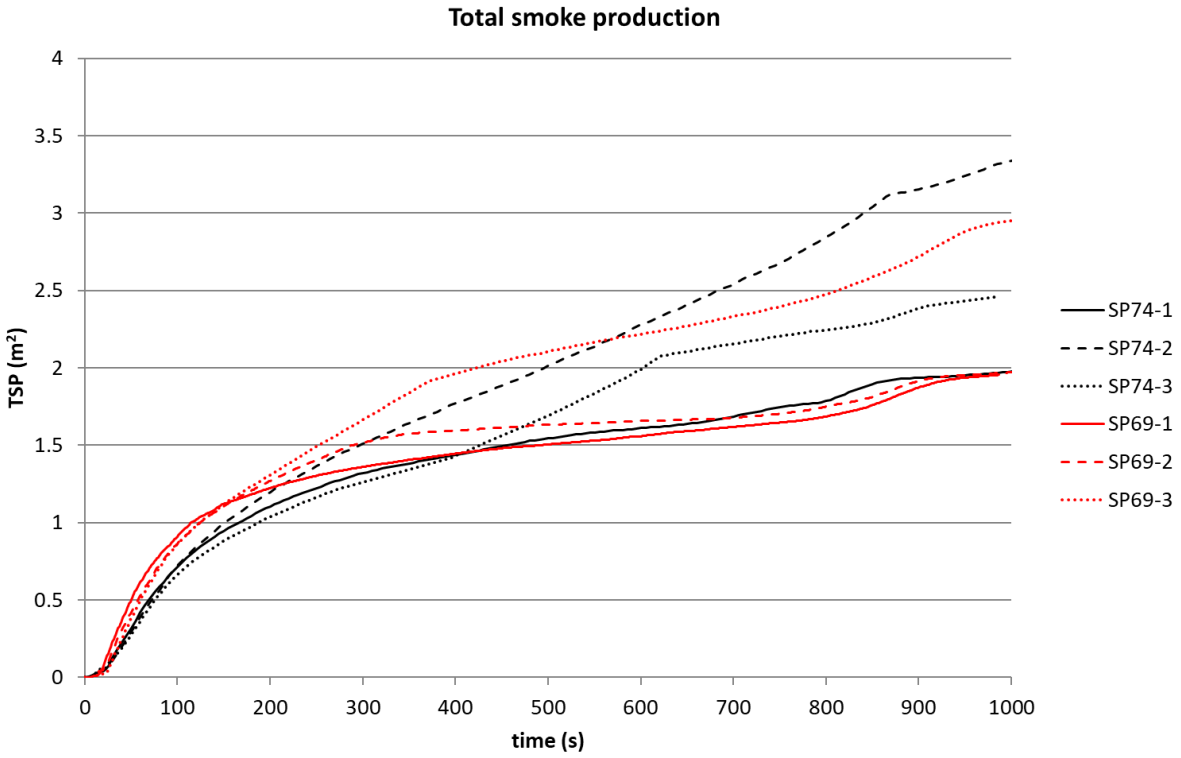
Graph 1: Measured HRR (heat release rate) with cone calorimeter.



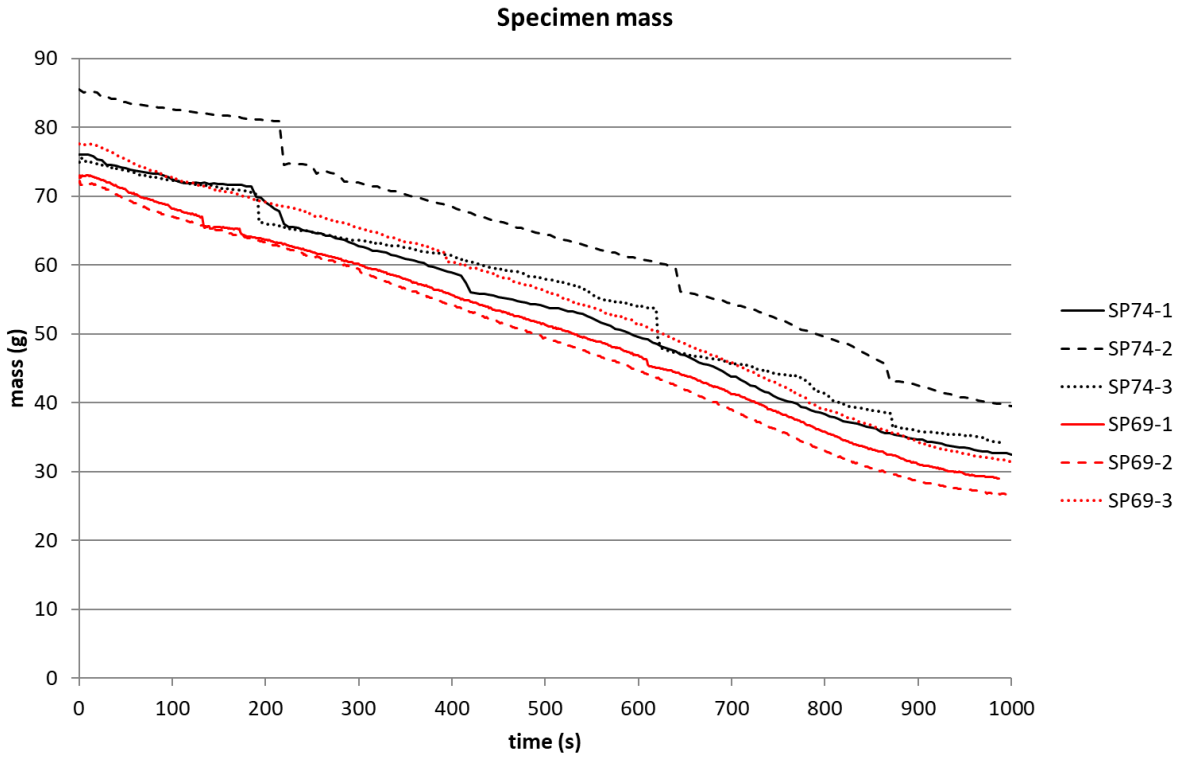
Graph 2: Measured HRR (heat release rate) with cone calorimeter, 30 s moving average.



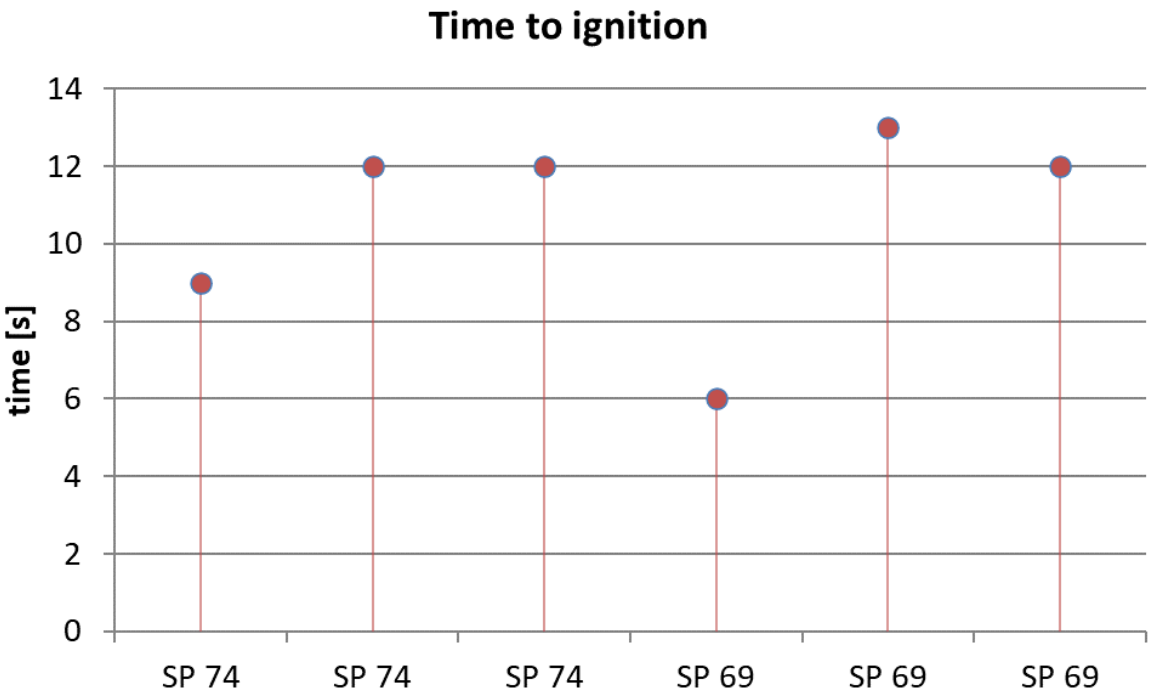
Graph 3: Measured THR (total heat release) with cone calorimeter



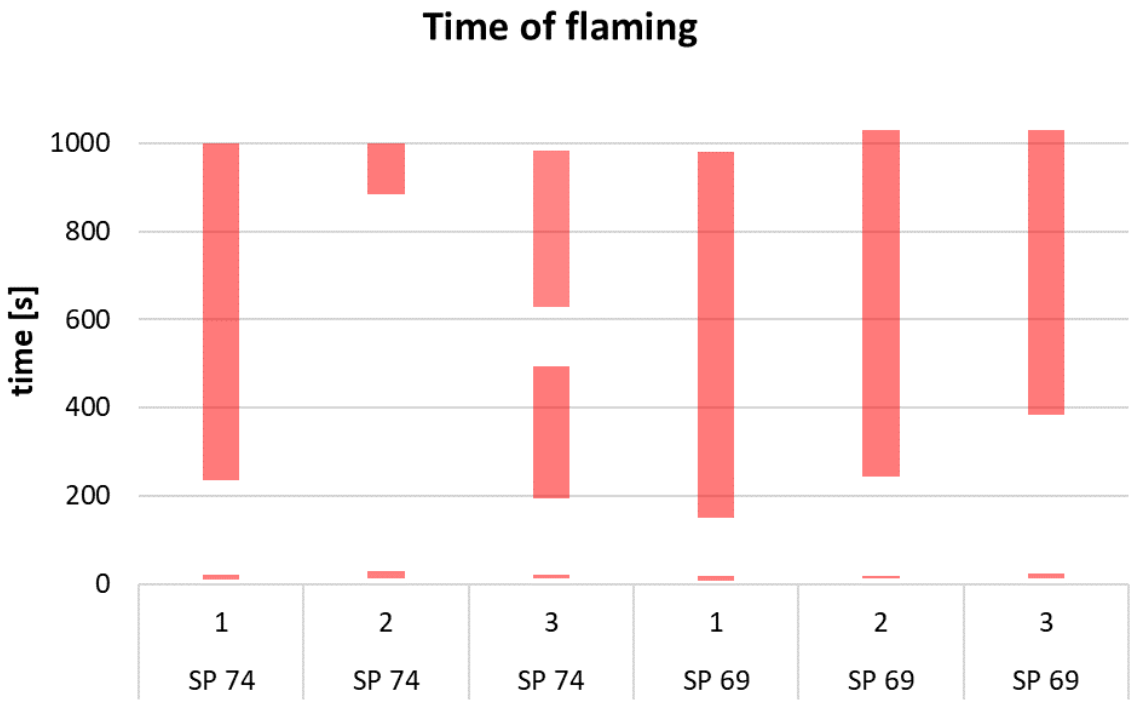
Graph 4: Measured TSP (total smoke production) with cone calorimeter.



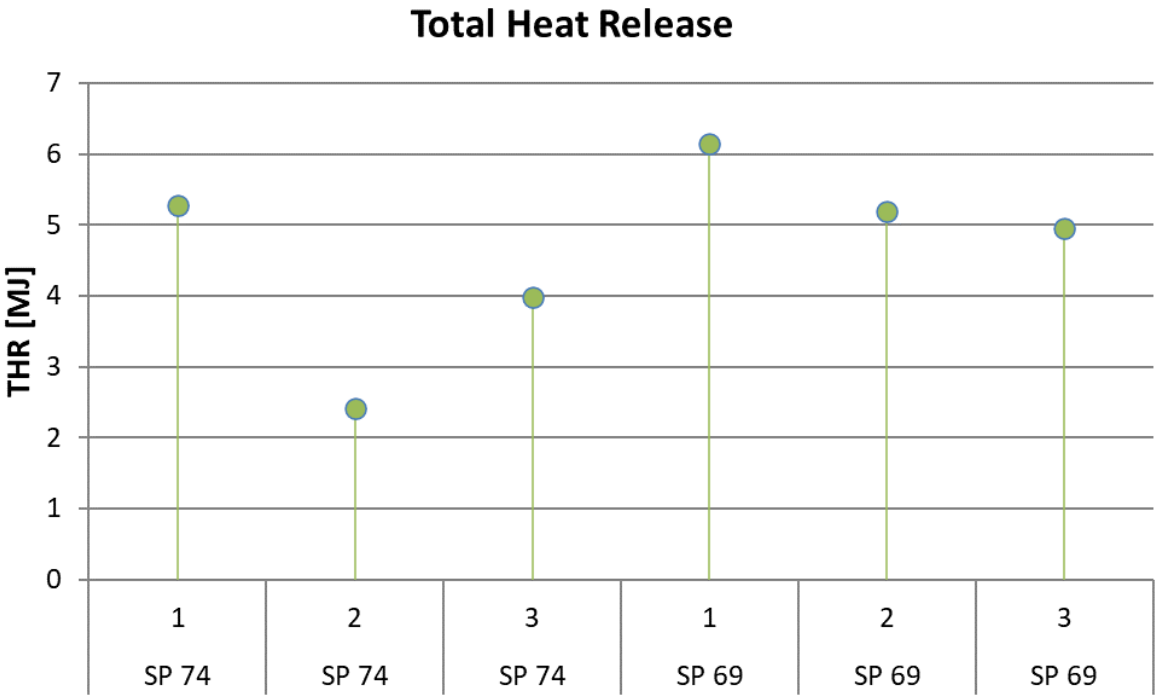
Graph 5: Specimen mass during cone calorimeter testing.



Graph 6: Time to ignition in the cone calorimeter tests.



Graph 7: Time of flaming in the cone calorimeter tests.



Graph 1: Estimated values of THR (total heat release) using ConeTools.