SINTEF

TEST REPORT

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NORSK
AKKREDITERING
Test 014

TITLE / TEST METHOD

Fire testing of Flawax
according to ISO 5660-1:1993

PRODUCT NAME

Flawax

CLIENT(S)

NorKem AS
P.O. Box 77
4064 Stavanger
NORWAY

CLIENT'S REF.

Mr. Kjell Arne Øvrehus

PROJECT NO.

102010.90/05.036

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Scientific adviser

REPORT DATE	TEST DATE	TOTAL NO. OF PAGES
2005-02-16	2005-02-15	6

ABSTRACT:

2 test specimens of the product **Flawax** were tested horizontally according to ISO 5660-1:1993. The tested specimens were exposed to a heat flux density level of 50 kW/m^2.

TEST RESULTS:

Test results are given in Appendix I.

During the tests, the material went from solid state to liquid state. An initial test showed the need for some special arrangement to keep the liquid in the test frame. During this test, most of the material flowed out, so the results from this test is not representative for the product and is therefore left out of this report.

PRODUCT DESCRIPTION:

Type of product:	Microcrystalline wax
Manufacturer:	NorKem AS
Place of production:	Stavanger, Norway
Sampling:	The tested material was selected by the client. The material subjected for testing arrived SINTEF NBL 2005-01-26. It is not known to SINTEF NBL if the fire characteristics of the product received is representative of the fire characteristics of the average product.
Test specimens:	2 test specimens with dimensions 100 x 100 mm, thickness 38 mm. Measured density and square density in solid state is shown in Appendix I, table 1.

More information about the product is filed at SINTEF NBL.

TESTING:

Operator:	Erling Stenhaug, engineer
Conditioning of the test material:	The test specimens were stored in air with a relative humidity of 50 % and a temperature of 23 °C until constant mass was obtained.
Number of single tests:	2 at heat flux level 50 kW/m^2 – see remarks

REMARKS / DEVIATIONS:

An initial test showed that the material went from solid state to liquid state when heated. This required special arrangement to keep the liquid in the test frame. During the initial test, most of the material flowed out, so the results from this test is not representative for the product and is therefore left out of this report.

APPENDICES

Appendix I:	Test Results
Appendix II:	Terms used for materials' reaction to fire

Appendix I - Test results

Table 1 Results from testing of **Flawax** according to ISO 5660-1, heat flux density 50 kW/m^2.

Specimen no		1	2
Irradiance level from cone	[kW/m²]	50	50
Specimen orientation	[H/V]	H	H
Exhaust system flow rate	[m³/s]	0,024	0,024
Specimen thickness	[mm]	38,0	38,0
Specimen surface area	[m²]	0,0088	0,0088
Specimen mass	[g]	336,7	320,8
Specimen density	[kg/m³]	885,93	844,29
Specimen square density	[kg/m²]	33,7	32,1
Specimen colour		Glossy white	
Time to ignition	[s]	81	98
Time to extinction	[s]	*	*
Duration of test	[s]	1200	1200
Mass remaining after test	[g]	175,2	164,6
Total mass loss	[g]	161,4	156,3
Total mass loss	[%]	47,9	48,7
Mass loss per square meter	[g/m²]	18343	17758
Mass loss rate per square meter	[g/m²s]	16,4	16,1
Total heat released	[MJ/m²]	747,9	729,2
Maximum heat released	[kW/m²]	793	775
Average heat release rate 180 s after ignition	[kW/m²]	336	321
Average heat release rate 300 s after ignition	[kW/m²]	475	458
Total heat release rate 300 s after ignition	[MJ/m²]	142	137
Max heat release rate, 30s sliding average	[kW/m²]	780	765
Effective net heat of combustion	[MJ/kg]	40,8	41,1
Total smoke production	[m²]	268,1	242,5
Average smoke production	[m²/s]	0;2225	0,2012
Average specific smoke production	[m²/kg]	1432,01	1302,77
Total CO-production	[g]	4,67	4,41
CO produced per mass unit burnt	[g/g]	0,0289	0,0282
Filename ("raw data")		**0503601**	**0503602**

* The material was still burning at termination of test.

Observations during the tests:
The material started to melt shortly after the tests were started. At ignition, the upper layer of the material was in liquid state – i.e. it was the liquid that ignited.

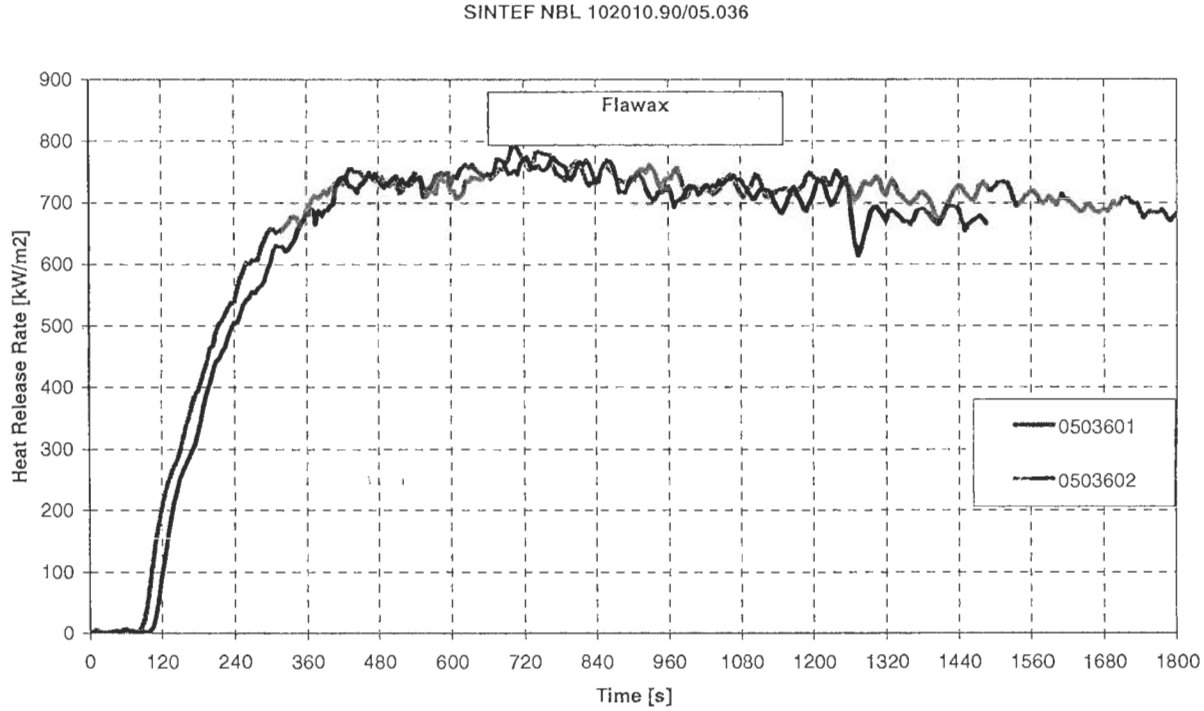

Figure 1 Heat release rate [kW/m^2] during testing of **Flawax** at irradiance level 50 kW/m^2

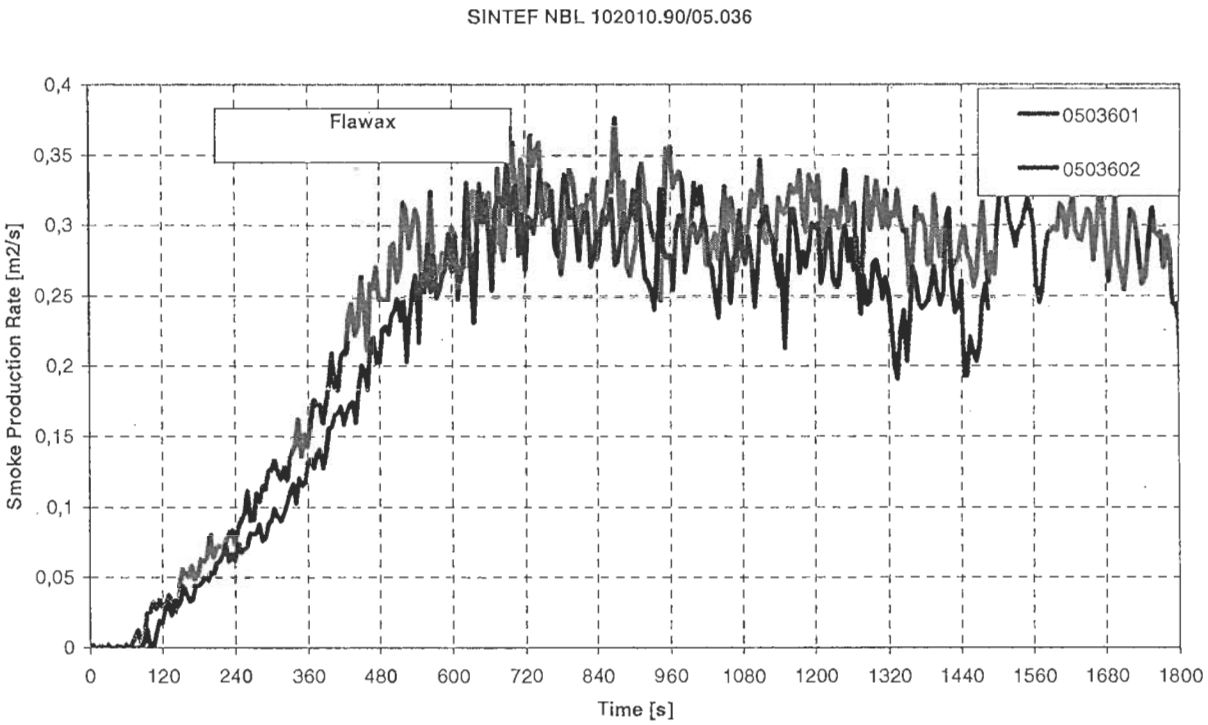

Figure 2 Smoke production rate [m^2/s] during testing of **Flawax** at irradiance level 50 kW/m^2

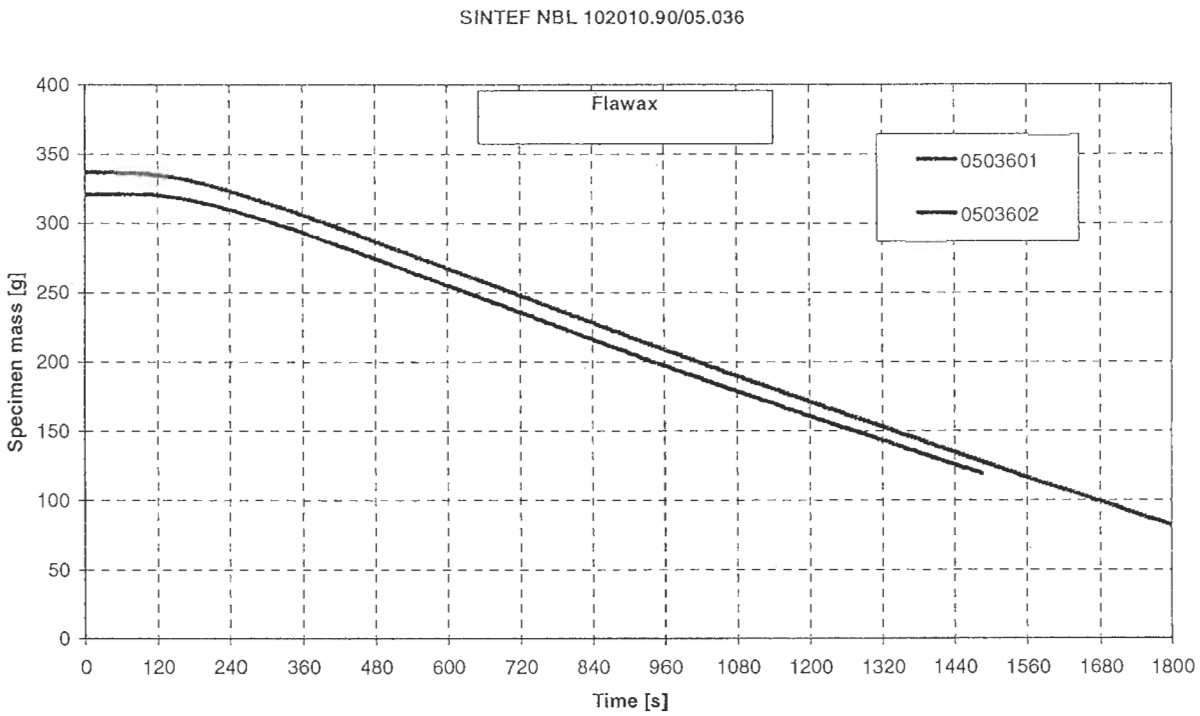

Figure 3 Specimen mass [g] during testing of **Flawax** at irradiance level 50 kW/m^2

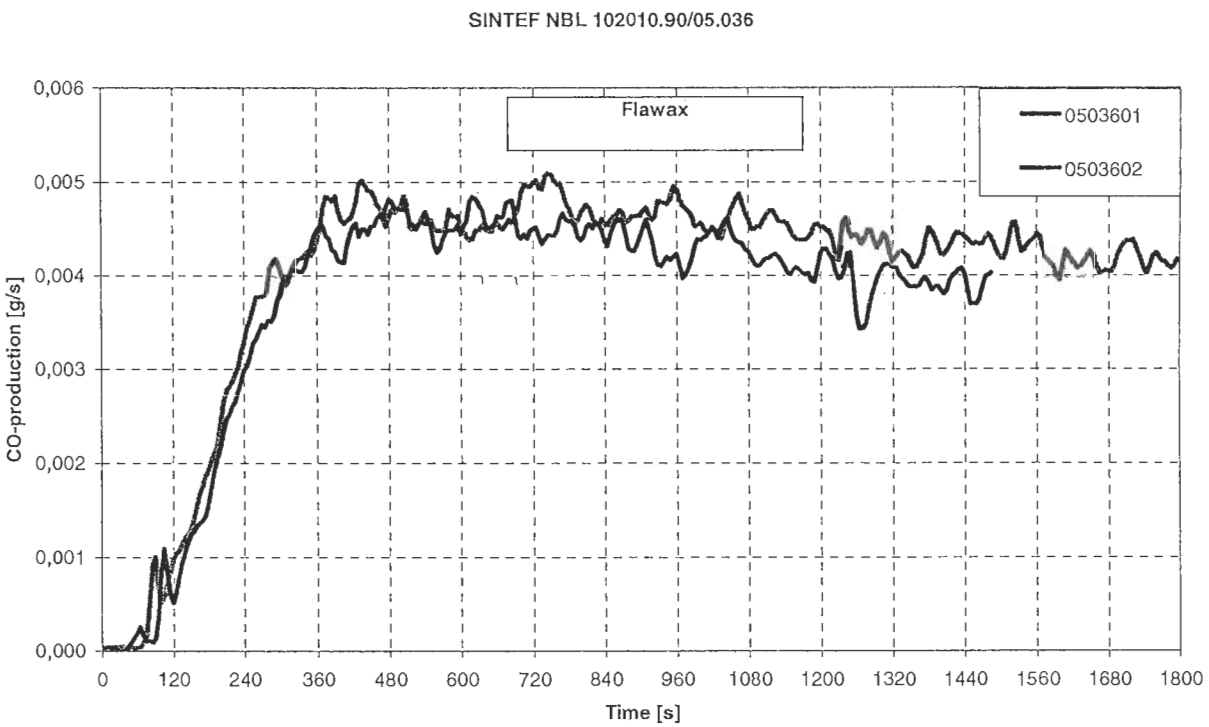

Figure 4 CO-production [g/s] during testing of **Flawax** at irradiance level 50 kW/m^2

TERMS USED FOR MATERIALS' REACTION TO FIRE

The cone calorimeter test is the most advanced method for assessing materials' reaction to fire. The test gives a possibility to evaluate ignitability, combustibility, smoke production and production of toxic gases. The different levels of irradiance from the cone, ranging from about 10 to 100 kW/m^2, represent various severity levels of external fires. A flash-over fire may result in heat loads in the range of 100 to 200 kW/m^2.

Irradiance level from cone [kW/m^2]	Represents the test condition by the external heat load to the specimen during fire testing.
Time to ignition [s]	Represents the time it takes to bring the specimen to ignition at the specified irradiance level, when a electrical ignition source is applied.
Total heat released [MJ/m^2]	Represents the total heat released from combustion reactions in the test specimen.
Maximum heat release rate [kW/m^2]	Represents the peak heat release rate from combustion reactions in the specimen.
Average heat release rate after 180 s [kW/m^2]	Represents the average heat release rate from combustion reactions during the first 180 seconds after ignition of the specimen.
Average heat release rate after 300 s [kW/m^2]	Represents the average heat release rate from the combustion reaction during the first 300 seconds after ignition of the specimen.
Effective heat of combustion [MJ/kg]	Represents the heat release from the combustion reaction in the specimen per unit mass at a specific irradiance level. (The heat of combustion measured in the cone calorimeter is normally significant lower than values given by other apparatuses. That is related to incomplete combustion in typical the fire conditions given by the Cone Calorimeter test.)
Average smoke production [m^2/s]	Represents the average extinction area of smoke gases produced during the fire test, i.e. a measure of optical smoke density.
Production of CO (carbon monoxide) [g]	Represents the mass of carbon monoxide produced during the fire test. The value is related to the actual test conditions only, i.e. a well ventilated fire. Other values for CO production may appear in real fires.
Average specimen mass loss [g/m^{2}s]	Represents the average mass consumption of the test specimen in the interval of 10% to 90% of total mass loss during the fire test.