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Fungal Resistance of Calcium Silicate Boards

22-10-2015

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Order no.: 647950

Danish Technological Institute, Wood Technology

Contents

1 Background and Purpose

The purpose of the test is to determine the ability to prevent fungal growth on aged surfaces of Calcium Silicate boards used as wall insulation.

2 Assignor

Skamol A/S
Fasanvej 7
DK-7860 Spøttrup

Attn: Kim F. Siefert

3 Test Materials

- Skamol 15-37-10-3
- Skamol Yantai Haohai 130
- Skamol Skamotec 225
- Gypsum boards (positive reference)
- Pine sapwood (comparative material)

Skamol 15-37-10-3, Skamol Yantai Haohai 130 and Skamol Skamotec 225 silica boards were delivered by Skamol A/S. The references were made at Technological Institute.

4 Method

ASTM G145-12a: *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

ASTM C1339-96: *Standard test Method for Determining Fungi Resistance of Insulation Materials and Facings.*

4.1 Ageing

Chamber: QUV apparatus
Lamps: UVA 351 (~normal daylight through window glass).

Cycle: 4 h UV at 60 °C and 4 h condensation at 50 °C.

Specimens of Skamol 15-37-10-3, Skamol Yantai Haohai 130 and Skamol Skamotec 225, gypsum boards and pine sapwood were cut and the front and backside of the materials aged in QUV.

QUV was carried out from 09-06-2015 to 23-07-2015 by Centre for Plastics Technology, Danish Technological Institute. Report no. 156/15. The exposed time was 1000 hours.

Organisms

Aspergillus niger	ATCC 9642
Aspergillus versicolor	ATCC 11 730
Penicillium funicolosum	ATCC 11 797
Chaetomium globosum	ATCC 6205
Aspergillus flavus	ATCC 9643

The fungi were cultivated on V8 agar plates for one week at 28°C.
The spores were harvested by adding 10 mL distilled water containing 0.1 g Tween 80/L per plate and the spores loosened with a Drigalski spatula. The spore suspensions were collected in a jar with glass beads and whirled to ensure even distribution of the spores and subsequently filtered through a layer of cotton wool. These cultures are designated stock cultures.
The amount of spores were counted in a counting chamber and then diluted with distilled water to a final concentration of $10^6 \pm 2 \times 10^5$ spores per mL.

Equal volumes of the diluted spore solutions were mixed and used for inoculation of the test specimens.

4.2 Exposure

From each type of boards 4 specimens with a dimension of 7.5 × 7.5 × 1.2 cm were cut.
2 of these specimens were cut from the front side aged specimens and 2 specimens were cut from the back side aged specimens.

The specimens were placed in petri dishes and inoculated by pipette with 10^5 spores per specimen. The petri dishes were placed at 28±2°C and 95±4% relative humidity for 7 weeks and evaluated once a week for fungal growth on the surface.

The evaluation was performed according to the scale below from BS 3900:1989 (*British Standard Method of test for paints. Part G6. Assessment of resistance to fungal growth).*

Rating	**Appearance**
0	No growth
1	Trace of growth up to 1 % coverage of test inoculated area
2	Growth more than 1 % and up to 10% coverage of test inoculated area
3	Growth more than 10 % and up to 30% coverage of test inoculated area
4	Trace of growth more than 30 % and up to 70% coverage of test inoculated area
5	Growth more than 70 % of test inoculated area

The exposure took place from 28-08-2015 to 16-10-2015.

After four weeks of exposure the amount of fungal biomass was determined by the MycoMeter®test. The MycoMeter®-test is based on the detection and quantification of an enzyme that is present in both mycelium and spores of most fungi. MycoMeter®-analysis is not a part of the standard.

The **MycoMeter®-values** are divided into the following three categories:

A	MycoMeter®value ≤ 25	The level of mould is not above normal background level
B	25< MycoMeter®value ≤450	The level of mould is above the normal background level. This is typically due to high concentration of spores in dust deposits but may in some cases indicate the presence of an old damage (mould growth)
C	MycoMeter®value > 450	The level of mould is high above normal background level due to mould growth

5 Results

Growth on surfaces

Material	Exposure (weeks) (Front/back)						
	1	2	3	4	5	6	7
Skamol 15-37-10-3	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Skamol Yantai Haohai 130	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Skamol Skamotec 225	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Gypsum boards (positive reference)	0/0	0/0	2/2	3/3	4/4	5/5	5/5
Pine sapwood (comparative material)	0/0	0/0	2/2	3/3	4/4	5/5	5/5

MycoMeter®-test

Material	MycoMeter®value	Category
Skamol 15-37-10-3	31	B (Low)
Skamol Yantai Haohai 130	40	B (Low)
Skamol Skamotec 225	81	B (Low)
Gypsum boards (positive reference)	228	B
Pine sapwood (comparative material)	452	C

On the tested material values were found corresponding to category B, although all values were considered as a low category B. In this test, a very large amount of spores was applied to the material that may be deemed unlikely to find in a building, which is consistent with the fact that we find values in category B for the tested material.

On the reference material values were found in category B and C which is consistent with the fact that growth was observed on these materials.

5.1.1 Skamol 15-37-103

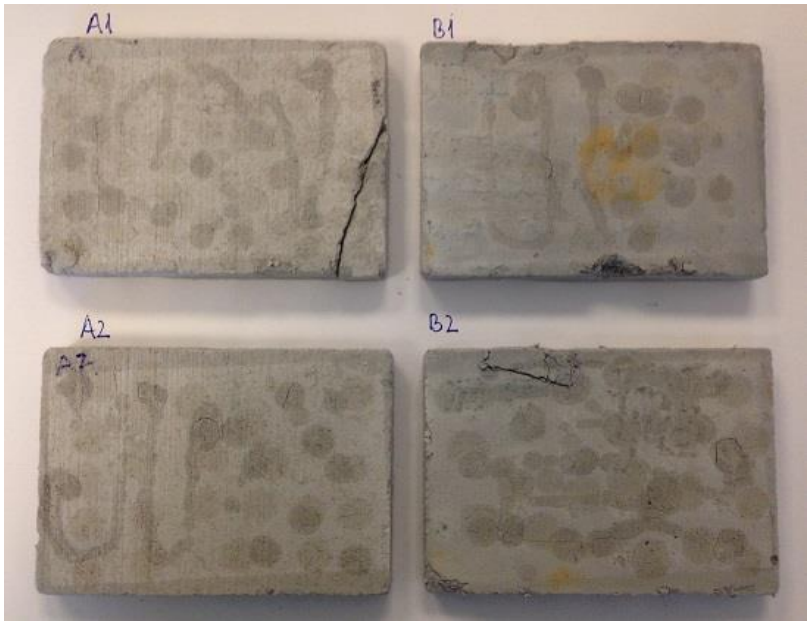

Photo 1. Skamol 15-37-10-3, no growth on surfaces after 7 weeks' exposure

Photo 2. Skamol 15-37-10-3, no growth observed in microscope.

After 7 weeks' exposure, no fungal growth were visible to the naked eye. In the microscope, the spores were observed but no mycelium.

5.1.2 Skamol Yantai Haohai 130

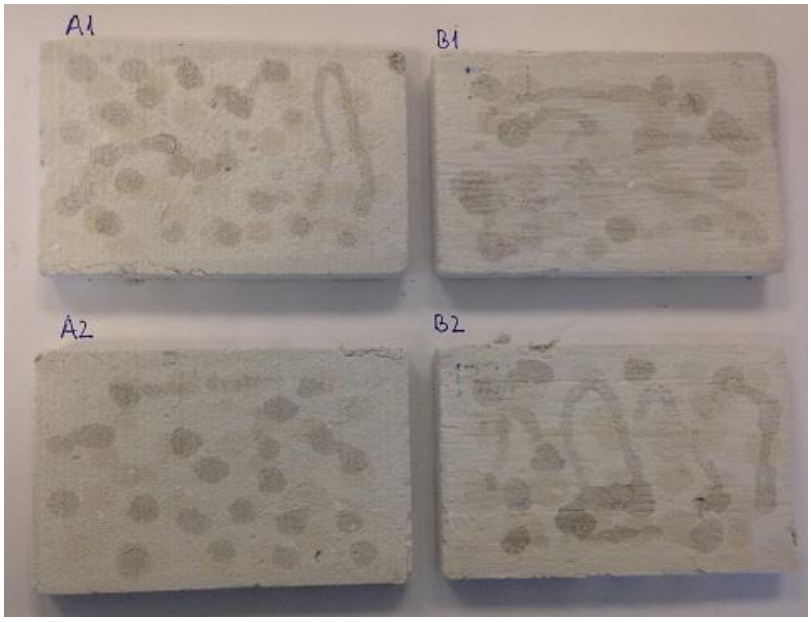

Photo 3. Skamol Yantai Haohai 130, no growth on surfaces after 7 weeks' exposure

Photo 4. Skamol Yantai Haohai 130, no growth observed in microscope.

After 7 weeks' exposure, no fungal growth were visible to the naked eye. In the microscope, the spores were observed but no mycelium.

5.1.3 Skamol Skamotec 225

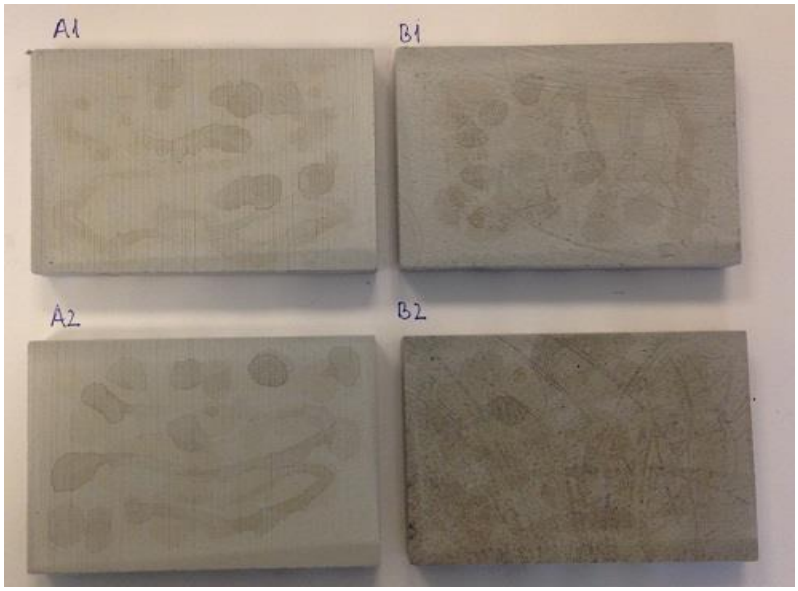

Photo 5. Skamol Skamotec 225, no growth on surfaces after 7 weeks' exposure

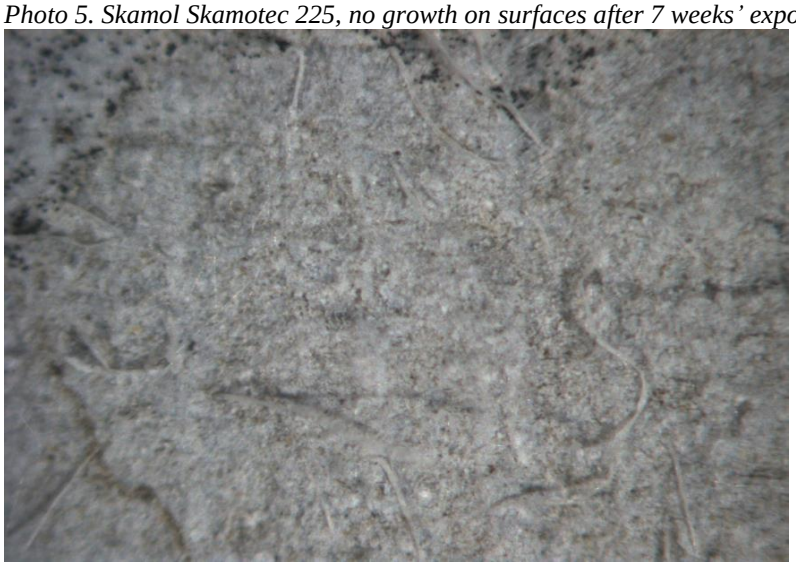

Photo 6. Skamol Skamotec 225, no growth observed in microscope.

After 7 weeks' exposure, no fungal growth were visible to the naked eye. In the microscope, the spores were observed but no mycelium.

5.1.4 Gypsum boards

Photo 7. Gypsum boards, growth on surfaces after 7 weeks' exposure

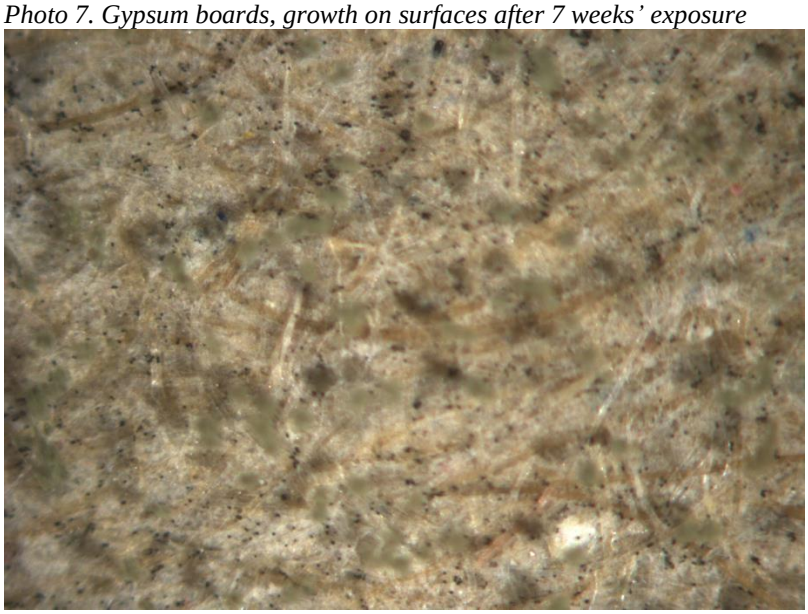

Photo 8. Gypsum boards, growth observed in the microscope

After 5 weeks' exposure, the surfaces of the Gypsum boards reference specimens were covered with visible fungal growth, and the paper on top of the specimens was damaged by moisture. Also in the microscope, heavy growth was observed.

5.1.5 Pine sapwood

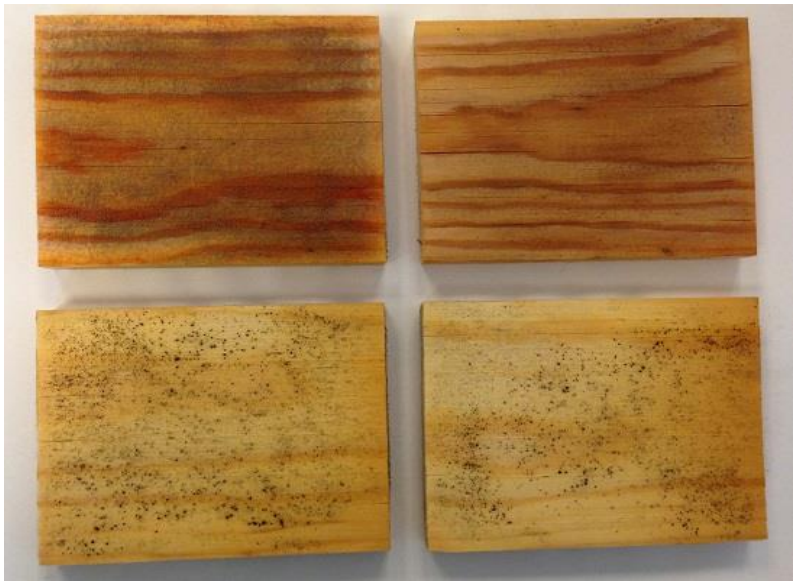

Photo 9. Pine sapwood, growth on surfaces after 7 weeks' exposure

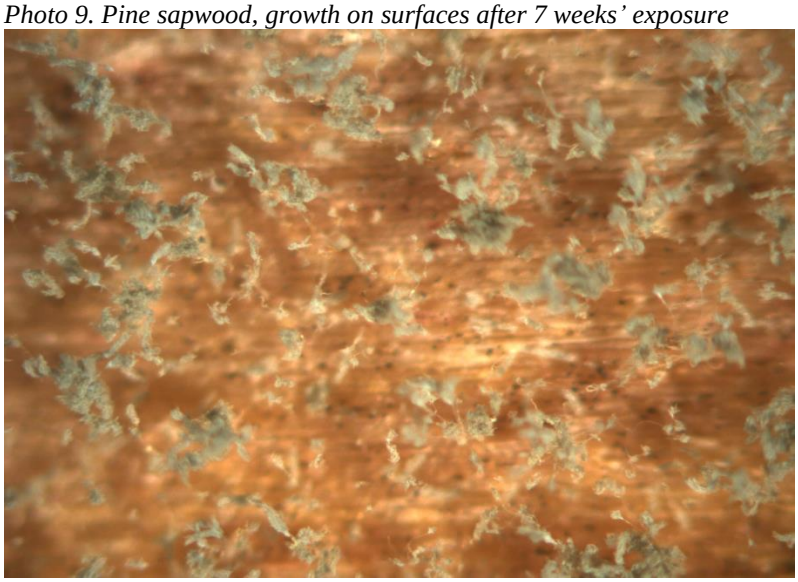

Photo 10. Pine sapwood, growth observed in the microscope

After 5 weeks' exposure, the surfaces of the Gypsum boards reference specimens were covered with visible fungal growth, and the paper on top of the specimens was damaged by moisture. Also in the microscope, heavy growth was observed.

6 Conclusion

The results demonstrate than the tested Skamol Silica Boards – Skamol 15-37-10-3, Skamol Yantai Haohai and Skamol Skamotec 225 were able to prevent growth of fungi on the surfaces when exposed to optimal temperature and high moisture content.
The specimens were exposed for 7 weeks.

On the reference material slight fungal growth was seen after 3 weeks and heavy growth after 5 weeks' exposure.

Yours sincerely
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