

Bunch Bygningsfysik ApS
Att: Dir. Tommy Bunch-Nielsen
Staktoften 22 A
2950 Vedbæk

July 2. 2018
Sagsnr. 5620-80
Amended
October 29. 2018

Investigation of board “PRS FirePro”

We have received a sample of the above boards. The board is 8 mm thick

It is claimed that the boards are less hygroscopic than ordinary MgO-boards because the Cl (chloride) in the binder has been substituted by SO₄ (sulphate)

Per agreement we will determine the composition of the boards and their tendency to moisture absorption

We have cut two samples 38 mm x 38 mm x 8 mm from the board for further analysis. The samples are designated 5620-80 No. 1 and 2

Procedure

- 1) Initially the composition of the boards is assessed by XRF-analysis directly on the 8-mm wide edge of the boards. XRF gives a semi-quantitative overview of elements with higher atomic number than sodium.

For information, the Mg/Cl-ratio is included in the result table. It seems that boards with a low Mg/Cl-ratio absorb water more willingly than samples with a high Mg/Cl-ratio. The mean Mg/Cl-ratio from many experiments with various MgO-boards is 2,5

- 2) In the absorption test the samples are weighed, dried 4 days at 102 °C, weighed again and then placed in a ventilated climate chamber at 20 °C / 90 %RH, and weighed regularly.

Previously we used a climatic chamber without ventilation at 23 °C / 93 %RH. The new procedure speeds up absorption with a factor 2-3



Furthermore, we have seen that the absorption process can be approximated by the equation

$$y = f * \sqrt{t}, \text{ where:}$$

y is the moisture content of the board (per cent weight compared to dry condition)

f is the slope of the graph (the straight line in the diagram y versus \sqrt{t})

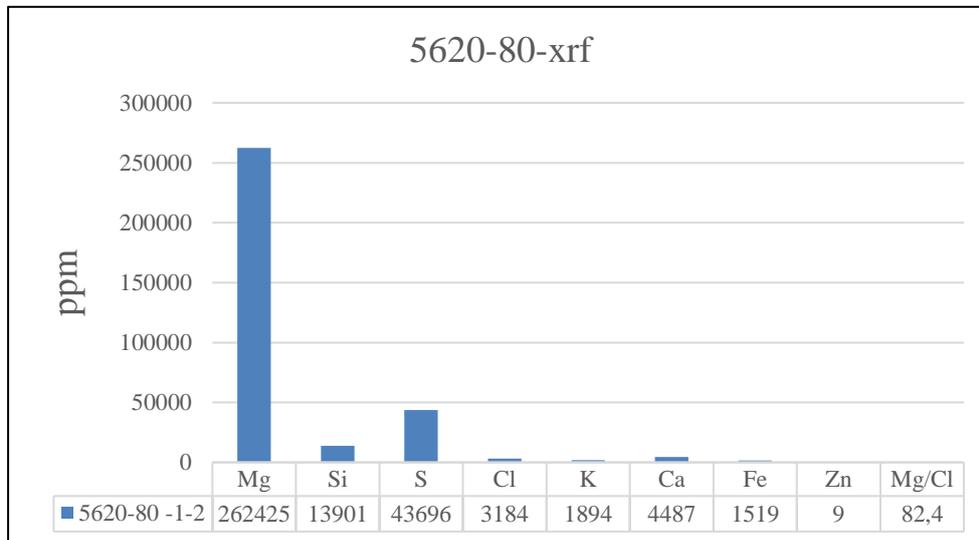
t is the time in days (24 h)

The f -value describes the willingness of the board to absorb water from the air. The larger the f -value, the faster the absorption, and the sooner will the board begin to “cry”

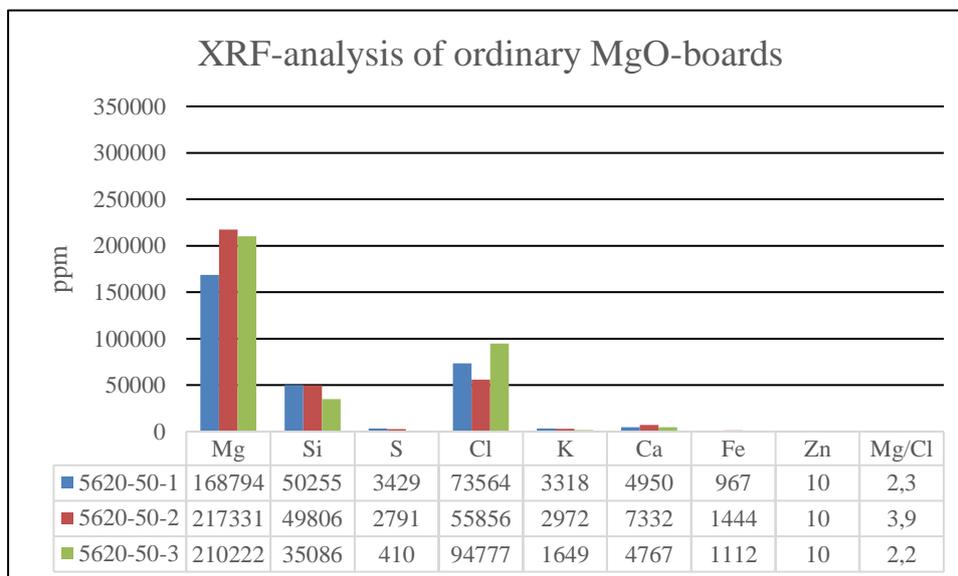
The f -value is stated in the report; its unit is [moisture% * (24 h)^{-1/2}]

The mean f -value from many experiments with various MgO-boards is 21

1: Composition of boards

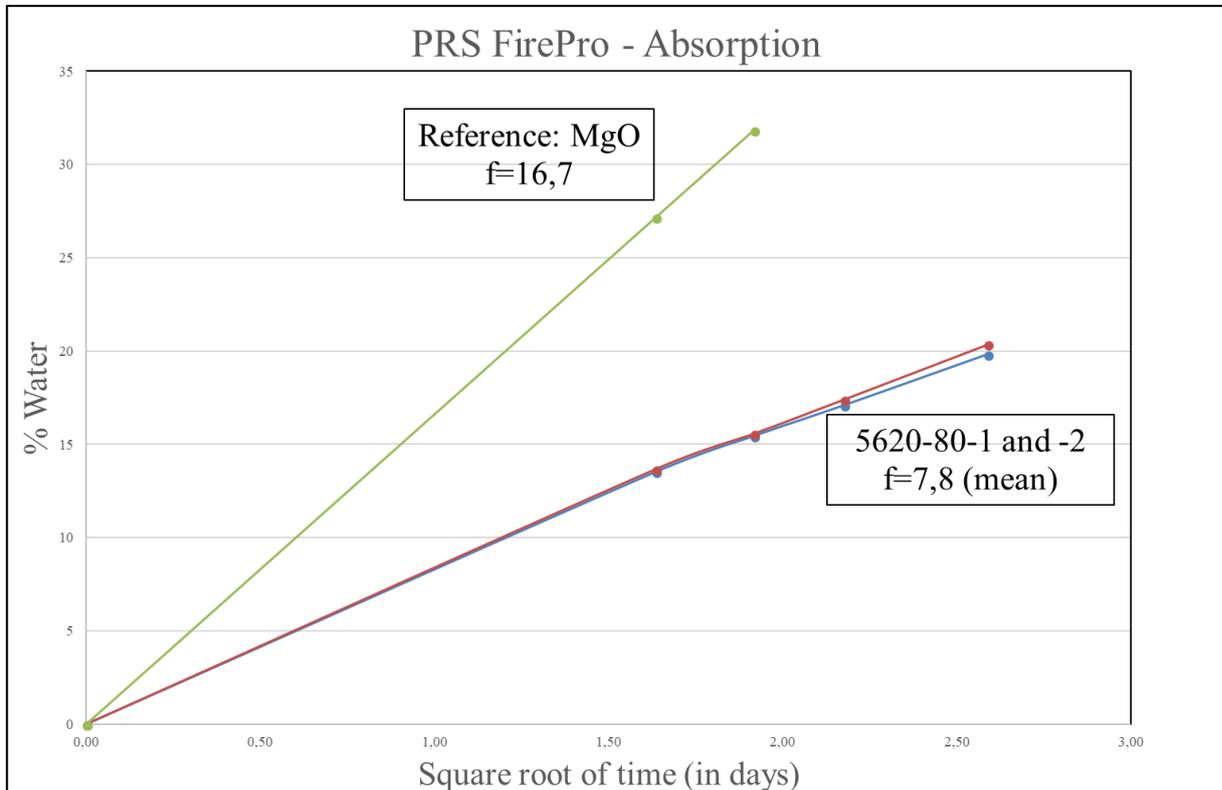


XRF-analysis directly on board samples. Results in ppm (10.000 ppm = 1 %). Organic matter with carbon, oxygen and hydrogen (e.g. wood fibers) is not included in the analysis. Elements in negligible concentrations are not included. The analysis is dominated by magnesium (Mg) and Sulphur (S) whereas the Cl-concentration is low. Consequently, the Mg/Cl-ratio is high. The content of Sulphur (S) is remarkably high



XRF-analysis of traditional MgO-boards inserted for comparison. Note the high Cl-content and the low concentration of S

2. Absorption



Moisture absorption at 20 °C / 90 %RH. The inclination of the first part of the graphs (mean) is 7,8 % moisture * (24 h)^{-1/2}. The mean of 3 ordinary MgO-boards (5620-1, 2 and 3) have been included for comparison. Liquid water (salt solution) formed on their surface around 30 % moisture content. No water has been formed on the “PRS FirePro” boards during the test period.

Sample	”f-value” [% moisture * (24 h) ^{-1/2}]	Mg/Cl
PRS FirePro	7,8	82
5620-50-1, 2 and 3	16,7	2,8

Survey of results. A high ”f-value” corresponds to fast water absorption. (The mean value for ordinary MgO-boards is 21). And usually a high Mg/Cl-ratio indicates a low absorption rate. (The mean value for ordinary MgO-boards is 2,5)

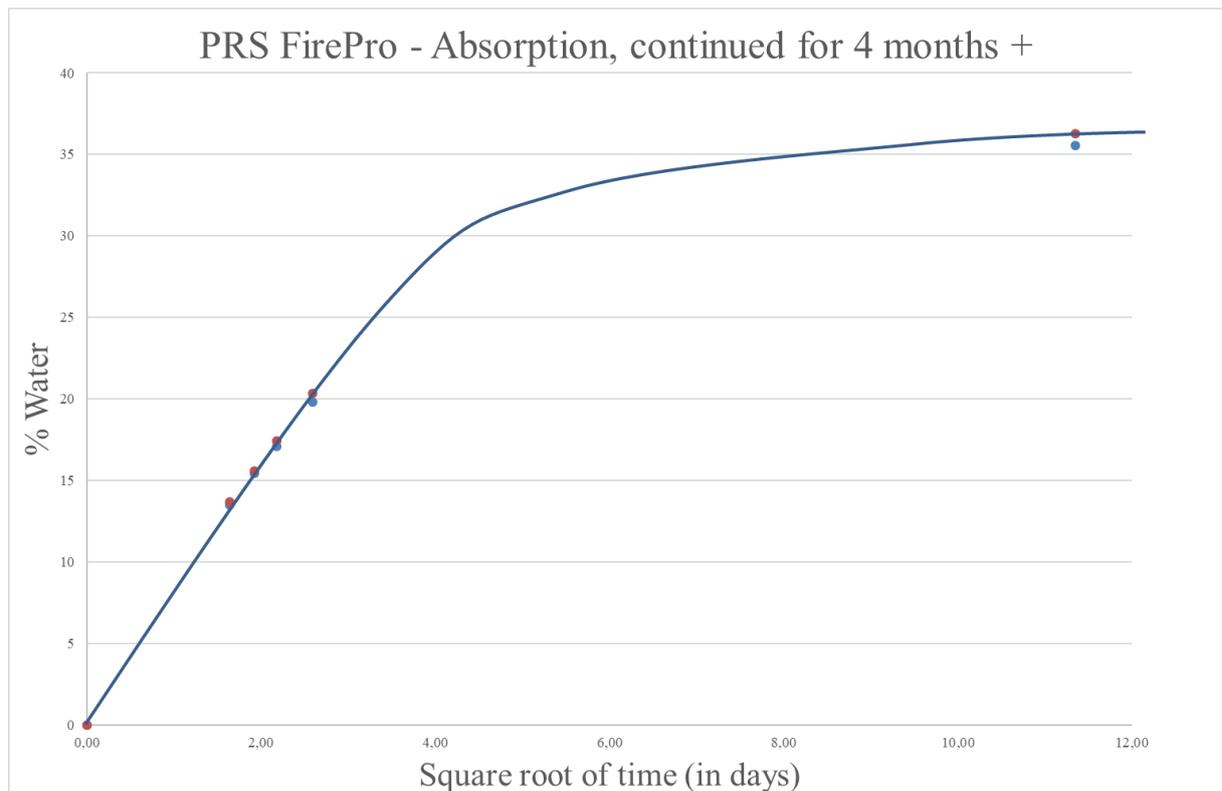
Other observations

No liquid has formed on the surface of the boards during 7 days of absorption. We did however observe a superficial cracking along some of the glass fibers on the smooth side of the board.

Continued exposure

The board samples have been placed in an unventilated chamber at 20 °C / 93 %RH for prolonged absorption to check whether they maintain their dry surface.

The exposure has been terminated after 4 months and a week. The absorption is shown below. Still no liquid has formed on the surface.



Comments

The tested "PRS FirePro" boards have a different composition than ordinary MgO-boards. The content of chlorine is 0,3-0,4 % compared to 5-10 % in MgO-boards. On the other hand, the tested boards have a relatively high content (4,3 %) of sulphur whereas MgO-boards only contain around 0,3 %

The tested "PRS FirePro" boards have not shown any signs of liquid water formation during a period of 7 days' absorption at 20 °C / 90 %RH in a ventilated chamber, neither after more than 4 months absorption in an unventilated chamber at 20 °C / 93 %RH

They have reached a level of 20 % water content after the 7 days, and they still absorb water, although at a much lower rate than ordinary MgO-boards. After the 4 months prolonged exposure the humidity has gone up to 36 %

Ordinary MgO-boards get liquid water on the surface at 30-35 % moisture content. However, these boards have remained surface dry.

Superficial cracks are formed along the glass fibers on the smooth side of the boards.

Kind Regards
Coating Consultancy

Peter Svane
M.Sc. (Chem.eng.)

Annex: Data

Dato, tid	2018-06-21 17:20	2018-06-21 17:20	2018-06-22 18:00	2018-06-25 10:05	2018-06-26 10:00	2018-06-27 11:30	2018-06-29 10:45	2018-10-29 12:00
Emne	Glas	Gl+prøve						
Vægt		Ny	Tør	Absorption	Absorption	Absorption	Absorption	Absorption
5620-80-1	12,4575	25,2123	23,548	25,0469	25,2599	25,4437	25,7474	27,4917
5620--80-2	12,3306	24,9186	23,2892	24,7883	24,9955	25,1967	25,5206	27,2672
Vægt		Prøve						
5620-80-1		12,7548	11,0905	12,5894	12,8024	12,9862	13,2899	15,0342
5620--80-2		12,588	10,9586	12,4577	12,6649	12,8661	13,19	14,9366
Dato, tid	% vand	2018-06-21 17:20	2018-06-22 18:00	2018-06-25 10:05	2018-06-26 10:00	2018-06-27 11:30	2018-06-29 10:45	2018-10-29 12:00
5620-80-1	5620-80-1	15,01	0,00	13,52	15,44	17,09	19,83	35,56
5620--80-2	5620--80-2	14,87	0,00	13,68	15,57	17,41	20,36	36,30
Tid, abs. Dage			0,00	2,67	3,67	4,73	6,70	128,82
Kvrod tid		Kvrod tid	0,00	1,63	1,91	2,17	2,59	11,35
% vand		5620-80-1	0	13,52	15,44	17,09	19,83	35,56
		5620--80-2	0	13,68	15,57	17,41	20,36	36,30

(All masses in g)