

Cembrit Oy

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Summary about durability of Cembrit flat sheets

The true durability of building materials can be found out only in real life out there. It takes a long time and therefore there's a need to speed up the testing of durability. Many different types of tests have been developed to evaluate the long term behavior of materials. This document summarizes them in brief.

Building materials face certain stresses during their service life. The materials must stand at least the following stresses: light, heat, cold, frost, wind, biological attacks, mechanical stresses, chemical stresses, dynamical stresses like earthquakes.

Light

Ultraviolet light (UV) causes more trouble than visible light, because UV light has shorter wavelength and therefore more energy. UV light is able to destroy organic materials by breaking the chemical bonds between molecules. The surface of organic substances slowly deteriorate: the surface wears out, loses its color and gloss. UV exposure is mainly a concern of paints and coatings. Uncoated fibre cement boards stand UV light very well, because the outer surface of the boards consists mainly of inorganic substances and they are not harmed by UV light.

UV irradiance is most severe at low latitudes where the Sun shines high above and especially in tropical regions of the Earth. But also higher latitudes have a certain level of UV light.

It is possible to speed up the effects of UV light in laboratory: there are light sources that have lots of UV light in their spectrum. The testing arrangements are usually divided in UV-A, UV-B and UV-C type of UV light. UV-A is closest to visible light and has the least energy of these three. It also represents real situation out there and gives the most reliable results. Usually this kind of testing is referred as QUVA: quick UV A testing. It also contains some moisture or even simulated rain.

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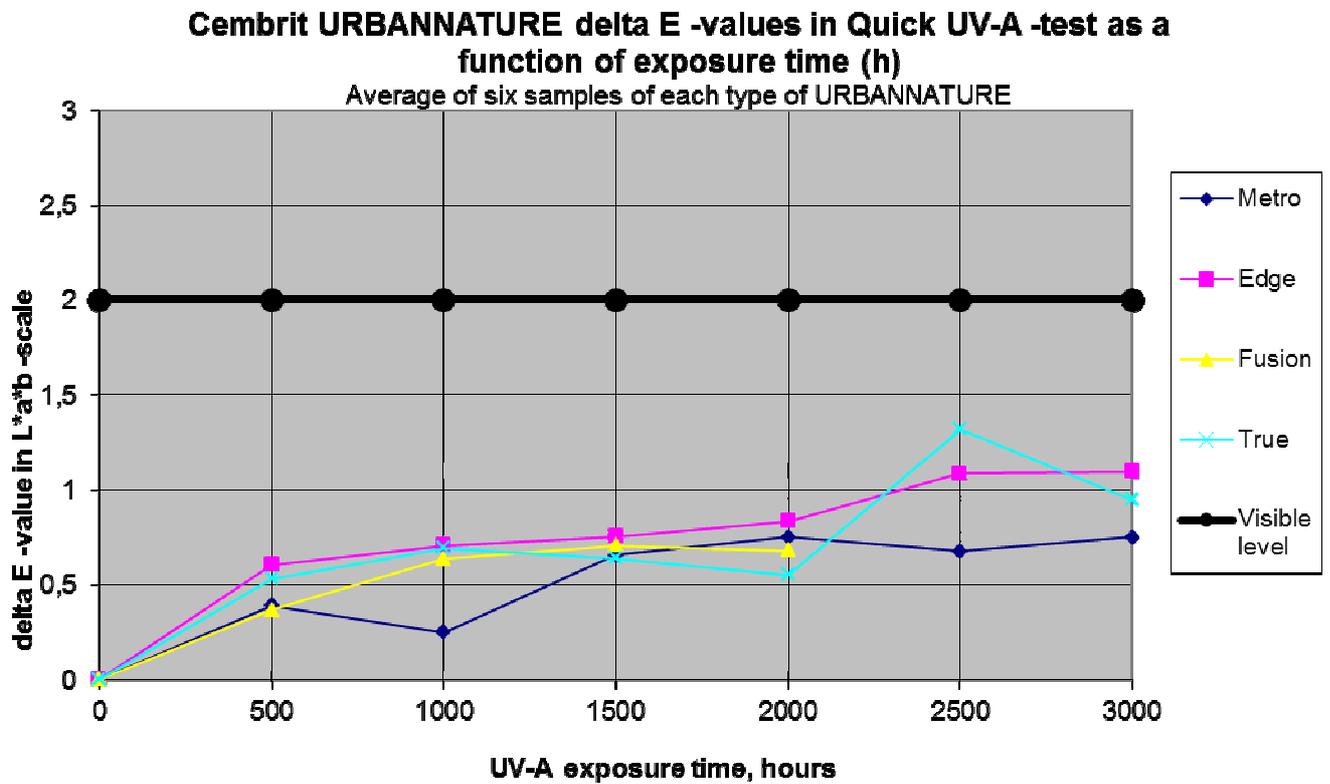
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Cembrit URBANNATURE boards have been tested in QUVA test for 3000 hours. This period corresponds 10 to 20 years of exposure in real life. The colour stability of Cembrit URBANNATURE boards is good in this test. The results can be expressed numerically in delta E values: it combines together the change in luminance (white – black), the change in green – red and the change in yellow – blue. The change in colour is regarded negligible if the value of delta E is less than 2.



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Heat

In facades and cladding exposure to heat is caused by sunshine. In addition to visible light sunshine also contains infra red (IR) radiation. It heats up the surfaces the Sun is shining at. The distance of the Earth from the Sun is about 150 million km (93 million miles) and at this distance the power of sunlight is about 1,3 kW/m². This energy heats the boards in the cladding up to 70 deg C (160 deg F) depending on the colour of the board – dark colours like black are heating more than light colours (white).

The heat itself is not harming the boards, but the accompanied change in moisture content is more critical to the durability of the boards. High temperature causes the boards to dry out and this drying makes the boards to shrink. If this shrinkage happens to be so big that the screws or rivets can't handle it, you'll notice cracks at the corners and edges of the boards. However, if you follow the Cembrit mounting and installation instructions carefully, you minimize the risk for cracking.

Coldness and frost

Low temperatures themselves do not cause any problems to the boards. But if you combine freezing temperatures with water, you may end up in severe frost damage. Solid water (read: ice) needs 11 % more space than liquid water. So if the pores inside the board happen to be filled with water, when the temperature falls below the freezing point, the ice tries to expand the structure of the board. This generates a tensile stress in the board and eventually it will release the bond between the plies on the board.

Cembrit cladding boards (Cembrit URBANNATURE and Cembrit Raw) are carefully formulated so that they stand well also in cold climates provided that you use the boards in their intended applications and you follow the Cembrit installation instructions.

Wind

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The claddings must stand the usual wind loads that are likely to happen during 100 years of service. Cembrit supplies wind load tables that explain how much load the boards are able to take. The factors that affect on this are: type of board, thickness, frame distance, type and number of mounting elements, distance of mounting elements. Please note that you have to follow the local building code when designing the mountings. Cembrit only tells how much the boards can stand; you need to find out the expected maximum wind load locally.

Biological attacks

There are pioneering species that conquer new surfaces and try to live and breed on them. They are typically bacteria, algae, lichen and moss. These species try to adhere to the surface of the boards. Cembrit Raw is more susceptible to this than URBANNATURE, because the surface is not coated at all and has a pore structure which makes it easier to populate. On the other hand, Cembrit URBANNATURE is painted and the paint has no pores so the rain water is able to flush the pioneers away from the surface.

Regarding Cembrit Raw, although the species can, in principle, adhere on the virgin surface of Raw, it is difficult to live on it during the first five years, because the surface is alkalic as any other cementitious surface. This high pH, about 12 or even 13, is caused by free lime released by the hydration reactions of Portland Cement. However in the long run Carbon Dioxide from air will neutralize the alkalic substances in the surface of the board and consequently making the surface easier to live on.

Mechanical stresses

The lowest row of the boards in the façade can be damaged in accidents or by vandalism. It may be necessary to replace the damaged boards. However, please keep in mind that usually it is easy to tell the new boards from the original ones. The old boards may have become dirty so the new boards clearly stand out in the façade.

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Dynamical stresses, earthquakes

Cembrit had an earthquake testing done in France for Cembrit URBANNATURE. The testing procedure contained a) a static displacement test up to 45 mm as a parallelogram, b) dynamic test with 45 mm amplitude and 1 to 2 Hz frequency and c) 4,65 mm amplitude with 6 Hz frequency. Both timber and aluminum frames were tested. The results were good.

Chemical stresses

Now that the acid rain problem has been solved there are no severe chemical stresses any more.



Ari Järmälä
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