Mercury Environment and Ageing Analysis

Customer:

Aurubis
Our Copper for your Life

Aurubis Finland Oy
FI-28100 Pori
Finland

Research Contract:

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ref.no: LuvataJuholata260207HS.pdf

Target:

Nordic Standard sample 15*21 cm².
The picture of the sample has been taken before the test.

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COLOUR

Test time:

The start of the Test: 4th of May, 2007
The end of the Test: 14th of June, 2007
Total test hours 1000 h

Purpose of the test:

To test the long term (colour and mechanical) endurance of the samples.

Test method:

Test cycle: 20 h of solar radiation and 4 hours of spray water
Spray liquid: pH5 tap water. The pH5 water is made by increasing few drops of H_2SO_4 to tap water
Black panel temperature: 80 ± 2°C during solar radiation cycles and room temperature during spray cycles
Intensity of radiation: 1500 W/m²
Total test time: 1000 hours

Validation of test method:

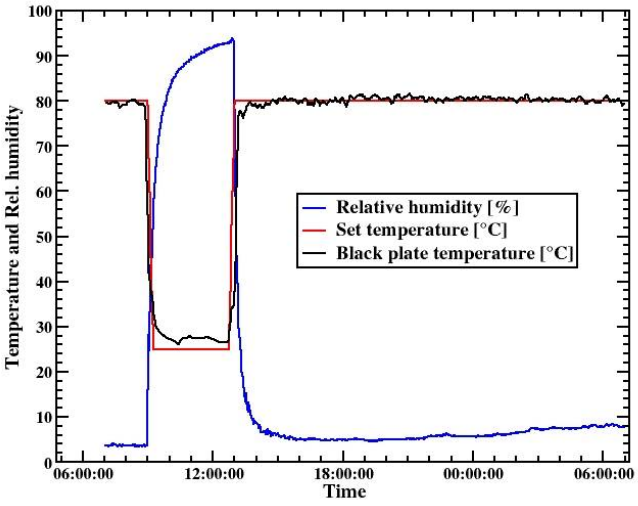
The temperature of a black surface on a roof can be around 70 - 80°C on a sunny day. The maximum solar radiation during a sunny day onto a surface can be around 1100 W/m². Higher radiation intensities accelerate the degrading effects of solar radiation.

Actions done:

The test cycle was as 20 h of solar radiation and 4 h of pH5 tap water spray. The spray liquid was made increasing few drops of H_2SO_4 to tap water. The mean intensity of solar radiation was 1500 ± 100 W/m². The mean black plate temperature was 80 ± 2°C during solar radiation cycles and 27 ± 4°C during water spray cycles.

The samples were situated during the test on aluminium stands at an angle of 45°. Some of the sprayed liquid stayed on the sample stands which caused degradation of those edges of the samples.

The black plate temperature, set temperature and relative humidity in the test chamber during one 24 hours cycle are in the next figure.



Colour coordinates

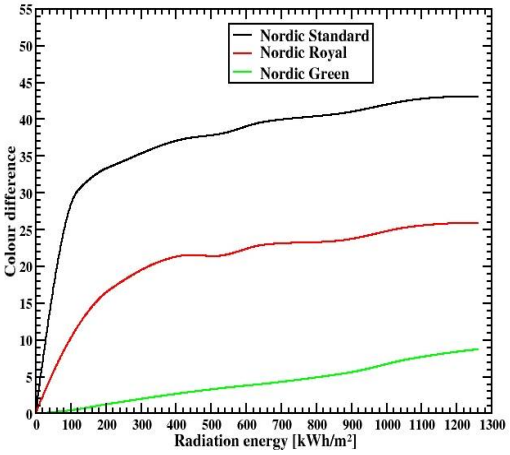
The L*a*b* colour coordinate values of the samples were measured and figured. The reflected specular component from the samples is included in the L*a*b* values. The colour difference DE compared to the original colour coordinates is also figured.

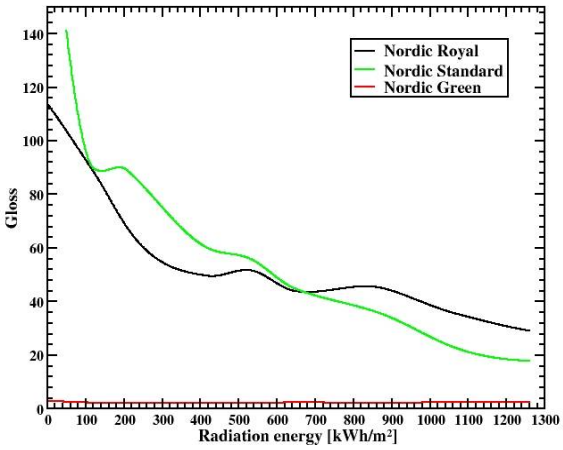
L*-coordinate indicates the lightness of the sample. The bigger the value the lighter the sample.
+a*-coordinate indicates the red direction and -a* indicates the green direction.
+b*-coordinate indicates the yellow direction and -b* indicates the blue direction.

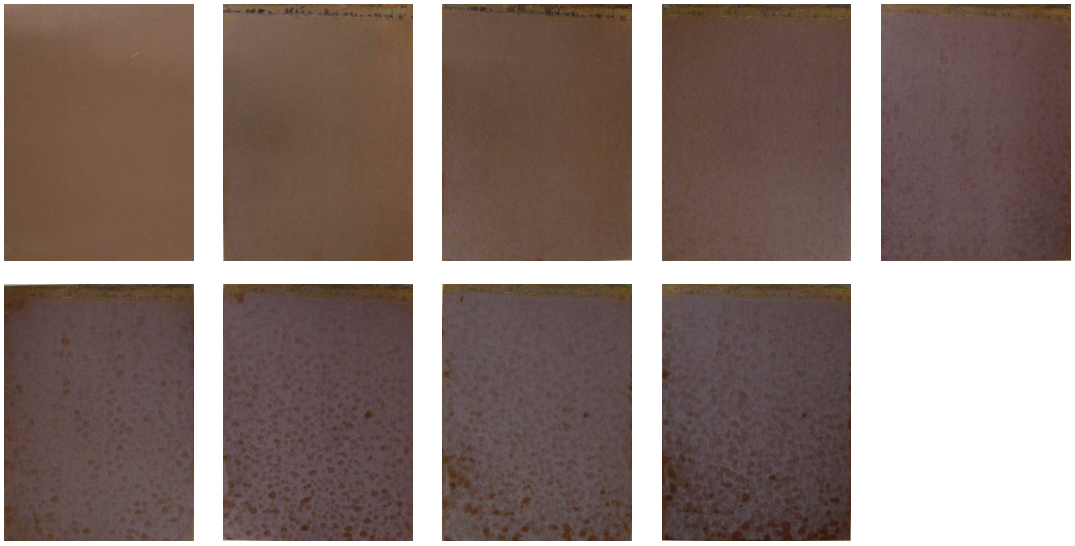
Under ideal viewing conditions a DE value of 1 represents a just perceptible colour difference to the human eye. However the human eye sees differently colour differences in different colours. The differences in darker colours are more perceptible to the eye.

Conclusions:

The colour differences and glosses of the Nordic Standard are figured.







Nordic Standard samples: Upper row from left, 0 h, 92 h, 168 h, 336 h and 426 h, lower row from left, 510 h, 702 h, 846 h and 1000 h.

Corresponding times in years for radiation energy outdoors are tabulated.

Location	Corresponding time for radiation of 1260 kWh/m² [years]
Northern Europe	1.3
Southern Europe	0.7

The strain of the test onto the samples was simulated solar radiation and sprayed tap water which was made acidic (pH5) by a few drops of H_2SO_4.

Remarks:

Actions, operations and reporting are in accordance with IEC/ISO 17025 'General requirements for the competence of testing laboratories'.

Signatures:

Littoinen

Timo Oksa
20th of June, 2007

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