SYSTEM FOR DETERMINISTIC ACCELERATION OF LABORATORY WEATHERING

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A realization of deterministic acceleration of laboratory weathering under controlled conditions is an essential requirement for delivering reliable and fast prediction of material durability in comparison to real use aging behavior. We present a laboratory weathering system capable of predicting the aging rate of material specimens, e.g. coatings, under interest independent on the aging mechanisms as a function of radiant exposure. The irradiance and the spectral power distribution will be extended above the normal level on earth surface while keeping all relevant temperature parameters fixed. These tests are performed in compliance with the essential international standards. As an example, we demonstrate the aging acceleration rate of different materials for the irradiance level of up to 2.5 suns (140 W/m² in the total UV range).

However, the applicability of an increased irradiance for deterministic acceleration of weathering without a specific knowledge of material properties requires that the degradation of material should be dependent on the applied radiant exposure only, irrespective of the irradiance level and resulting exposure duration used during the test. For some materials fulfilling this criterion, the acceleration of weathering has been demonstrated successfully.[1,2,3,4]

It is of essential importance to validate an appropriate test procedure under controlled conditions in laboratory with an artificial light source which can provide high irradiances above the natural level with the spectral power distribution closely mimicking the natural solar radiation. Simultaneously, the temperature of the sample specimen surface and of the ambient air must be kept constant in a wide range of irradiance level. In addition the usual wetting and rain option should be available.

The test procedure is validated with well known standard reference materials.[7,8,9]

Table 1: Summary of the test results where no water spray was applied. Exposure in accordance with ISO 4892-2[5,6] with different irradiance levels (55W/m² to 140W/m² (wavelength range 300nm-400nm)) without application of water spray cycle. SRM- standard reference material, A- axis intercept, M-slope in Δ E* /(MJ/m^2) for ORWET ORANGE and Blue Wool Type 6 (Δ b* /(MJ/m^2) for PS chip), R²-Pearson correlation coefficient.

SRM	ORWET Orange		PS Chip		Blue Wool Type6	
Zero point	included	excluded	included	excluded	included	excluded
A	0	-1.23	0	0.49	0	0.98
M	0.23	0.25	0.07	0.06	0.16	0.14
R²	0.98	0.99	0.89	0.92	0.91	0.93

In Table 2 the results of the test where no water spray was used is summarized. The effect and a correct application of the rain phase needs further careful investigation.

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