Atlas Application Note 107

In Vitro SPF Testing

Atlas SUNTEST® CPS+ and its use for the in vitro UVA sun protection factor (SPF) determination in the cosmetic industry

Atlas Material Testing Technology

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Background

Over the past 10 years there have been concerted efforts worldwide to work out an in vitro testing of UVA protection of commercial sunscreen products to reduce or replace existing in vivo testing. The COLIPA (European Cosmetic and Perfumery Association; today Cosmetics Europe) successfully published a first guideline "Method for the in vitro determination of UVA protection provided by sunscreen products" in 2007 which became further improved by the revision done in 2011. [1]

In Vitro Testing

The in vitro test methods of both COLIPA (2011) and ISO 24443 are based on the measurement of UV radiation transmittance through a thin film of sunscreen which is manually applied to a special PMMA plate (Figure 1) of defined size and, quality and surface roughness [2] [3]. The UV transmittance characteristic of the sunscreen is measured with a Spectrophotometer before exposure to a UV radiation source and after.

***Figure 1**: Image Courtesy Labsphere Corp*

The spectral irradiance of the test chamber used to provide the UV stress shall be as similar as possible to the irradiance at ground level under a standard zenith sun as defined by COLIPA SPF Test Method (1994) or in DIN 67501. Additionally, the UV (290-400 nm) irradiance shall be within a certain range between 40-200 W/m^2 and irradiance ratio of UVA/UVB between 8 to 22. [2]

Atlas SUNTEST CPS+

Atlas SUNTEST CPS+ is the most trusted UV test chamber for the above-mentioned in vitro UVA test methods. Originally developed for the accelerated aging testing of plastics and other materials, Atlas quickly optimized it also towards pharmaceutical drug and cosmetics testing when both industries realized its benefits of a compact reliable solar simulator in the 80ies and 90ies.The SUNTEST as today provides compliance to the required spectrum mentioned above by using an air-cooled 1500 W xenon lamp in combination with an optical daylight filter. Additional IR-reflecting mirrors reduce a great portion of unwanted IR heat waves (Figure 2). The irradiance inside the SUNTEST is automatically controlled by a wideband 300-800 nm light monitor inside the chamber and dimmable.

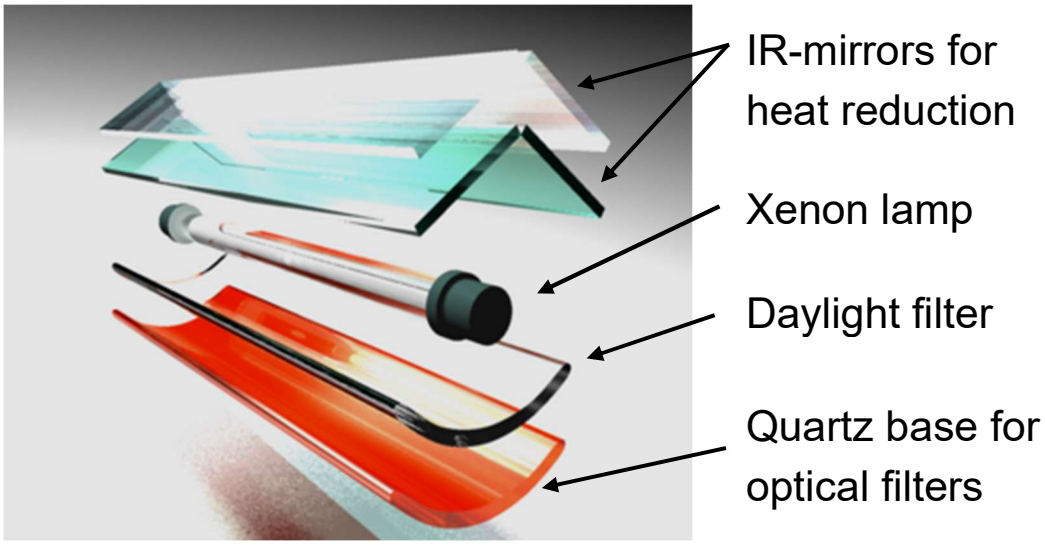

***Figure 2**: Optical design of Atlas SUNTEST CPS+ with 1500 W xenon-arc lamp and optical filters*

SunCool chiller and SunTray sample exchanger

The test temperature between 25-35 °C are controlled even at highest SUNTEST irradiance settings by a refrigeration unit called SunCool which feeds in chilled air. To complete the ideal test setup, there is a specimen handling accessory named SunTray (Figure 3). The SunTray is a sample exchanger unit underneath the SUNTEST and includes a holder for 8 standard PMMA plates. It allows for fast and safe exchanging of samples during the SUNTEST in continuous light mode. It's both practical and the continuous light mode takes care of the SUNTEST xenon lamp which would suffer from frequent ON/OFF switches caused by short UVA test durations of a few minutes.

***Figure 3**: In vitro UVA test setup with SUNTEST CPS+, SunCool and SunTray accessories*

Overview In Vitro UVA Test Methods COLIPA and ISO

Test Parameter	COLIPA (2011)	ISO 24443 (2012)
Plates	PMMA	PMMA
Replicates	4	4
Pre-Irradiation Spectrum	close to COLIPA (1994)	close to COLIPA (1995)
Pre-Irradiation Spectrum requirements	UVA/UVB 8-22	UVA/UVB 8-22
UV Irradiance (290-400nm)	50-140 W/m^2	40-200 W/m^2
Sample Temperature	< 40 °C	25-35 °C
Recalibration	18 mths or 3000 h	18 mths or 3000 h

References

[1] D. Moyal, V. Alard, C. Bertin, M.W. Brown, L. Kolbe, P. Matts and M. Pissavini, International Journal of Cosmetic Science, February 2013, Volume 35, Issue 1, Pages 1–111

[2] COLIPA (2011), Method for in vitro determination of UVA protection

[3] ISO 24443:2012, Determination of sunscreen UVA photoprotection in vitro

Atlas Material Testing Technology |1500 Bishop Court | Mount Prospect, Illinois 60056, USA
www.atlas-mts.com