

UVITA SME™ SPECTRAL MODIFIERS AND ENHANCERS

A NEW APPROACH TO ULTRAVIOLET PROTECTION AND LIGHT STABILIZATION

UVITA SME [™] and PLASMONICS

CLIMATE CHANGE THE WORLD IS HEATING UP ULTRAVIOLET RADIATION IS INCREASING



ULTRAVIOLET LIGHT IS PART OF THE ELECTROMAGNETIC SPECTRUM BETWEEN VISIBLE LIGHT AND X-RAYS.

The entire electromagnetic spectrum is shown below.



THE WAVELENGTH RANGE OF OPTICAL RADIATION

According to DIN 5031, the term "optical radiation" refers to electromagnetic radiation in the wavelength range between 100 nm and 1 mm. The terms "light" and "visible radiation" (VIS) refer to the wavelength range between 400 nm and 800 nm, which can be perceived by the human eye. Optical radiation with wavelengths shorter than 400 nm is called ultraviolet (UV) radiation and is further subdivided in UV-A, UV-B and UV-C ranges. Similarly, infrared (IR) radiation covers the wavelength range above 800 nm and is subdivided in IR-A, IR-B and IR-C ranges (DIN 5031, part 7).

100nm	200nm	600nm						800nm	1000nr 1200nr 1400nr	1600nm 1800nm	3,0µm	1mm			
	UV: Ultraviolett Radiation			VIS: Visible Radiation; Light								IR: Infrared Radiation			
	UV-C 100-280nm	V-B 280-315nm	UV-A 315-400nm	violet	blue	bluegreen	green	yellowgreen	yellow	orange	red	IR-A 800-1400nm	IR-B 400nm - 3,0µm		IR-C 3,0µm - 1mm

EXPLANATION OF TERMS

INFRARED is invisible radiant energy, electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 700 nanometers (frequency 428.27 THz; 1.77 eV) to 1 mm (300 GHz; 1.24 meV), (although people can see infrared up to at least 1050 nm in experiments).

PLASMON In physics, a plasmon is a quantum of plasma oscillation. As light consists of photons, the plasma oscillation consists of plasmons. The plasmon can be considered a quasiparticle since it arises from the quantization of plasma oscillations, just like phonons are quantizations of mechanical vibrations. Thus, plasmons are collective (a discrete number) oscillations of the free electron gas density, for example, at optical frequencies. Plasmons can couple with a photon to create another quasiparticle called a plasma polariton.

UVITA SME[™] and PLASMONICS

- Uvita SME[™] plasmonics technology provides permanent and broad sustainable UV protection, with no migration or extraction from 200 to 800 nm and into the near to far IR.
- Uvita SME[™] is highly synergistic with other UV light stabilizers, including hindered amine light stabilizers (HALS).
- Uvita SME[™] provides plasmonic UV protection and stabilization for all plastics and coatings, without the common restrictions of red and blue shifts and hypsochromicity.
- Uvita SME[™] produces a consistent hyperchromic shift with other UV light stabilizers, never before seen in the history of light stabilizers.
- With Uvita SME[™] there is an electromagnetic transfer of excited electrons from the surface of the particle to form a plasmon cloud over the particle, and transference of that energy to the conductive band of the organic UV absorbers

EXPLANATION OF TERMS

BATHOCHROMIC SHIFT is a change of spectral band position in the absorption, reflectance, transmittance, or emission spectrum of a molecule to a longer wavelength (lower frequency). Because the red color in the visible spectrum has a longer wavelength than most other colors, this effect is also commonly called a *red shift*.

HYPOCHROMICITY is the decreasing ability of a material to absorb light. **HYPERCHROMICITY** is the increasing ability of a material to absorb light.

HYPSOCHROMIC SHIFT is a change of spectral band position in the absorption, reflectance, transmittance, or emission spectrum of a molecule to a shorter wavelength (higher frequency). Because the blue color in the visible spectrum has a shorter wavelength than most other colors, this effect is also commonly called a *blue shift*.

UVITA SME [™] SPECTRAL MODIFIERS AND ENHANCERS

Polymers requiring long term broad UV protection will benefit from this disruptive innovation in technology

Uvita SME[™] products work well alone or especially well in combination with organic ultraviolet absorbers, and with their counterparts in hindered amine light stabilizers (HALS). They are highly suitable for use in hot climates and high humidity environments, and have no restrictions in their maximum wavelength absorption (lambda maxima).

Uvita SME[™] products are the result of green chemistry derived from sustainable resources. They complement all organic UVA and HALS synergistically, by increasing the absorbance of the UVA and HALS in the polymer system, while showing hyperchromicity and bathochromic shifts to higher wavelengths.

UVITA SME[™] in combination with HALS and organic UVA, also slows down in-situ consumption when exposed to UV radiation.

They are very cost-effective and highly efficient in applications such as:

- CONTROL OF POST-HARVEST FOOD PACKAGED IN PLASTICS.
- INSECT VECTOR CONTROL DURING CROP PRODUCTION.
- LAMINATED THERMOPLASTIC FILMS OVER PIGMENTED PLASTIC.
- DECKING AND ROOFING, AND SIMILAR APPLICATIONS.
- PROTECTION OF FOOD PACKAGING AND OILS BEYOND THE 400 NM RANGE.

Very long term to permanent broad UV protection is the key to superior performance. Uvita[™] SME technology to achieve this is available today.

There are no known limitations for the use of this technology, which has been tested in condensation polymers, PET fibers, cast films and PETG, with no adverse effects.

UVITA SME[™] – TRANSMISSION IN FILM



Uvita SME[™] – Transmission in Film



Uvita SME[™] – Absorbance in Film



Uvita SME[™] – Spectral Absorbance in Film

LDPE film, one mil - initial absorbance versus outdoor exposure for 105 days

Uvita SME[™] and HALS



Uvita SME[™] and Hydroxy substituted Benzophenone UVA .

LDPE one mil film, 500 hours outdoors exposure of one side versus QUV



INJECTION MOLDED POLYPROPYLENE





INJECTION MOLDED POLYPROPYLENE

UVITA SMETM IN THICK SECTION TPO AND TPE VIRTUALLY TOTAL BLOCKAGE OF HARMFUL RADIATION AND PROTECTION OF COLORANTS IN TPE ELASTOMERS

UVITAGARD SME 3811 -3 & 4 FOR THICK SECTION TPO AND THERMOPLASTIC ELASTOMERS



UVITA SMETM IN FLAME RETARDANT FABRICS

Uvita SME[™] in combination with a FR was spun into 1 denier per filament fibers for UV-FR clothing. 2,400 fibers all one denier per filament with Uvita SME[™] and flame retardant

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