

# HIGH PERFORMING TITANIUM DIOXIDE DISPERSIONS

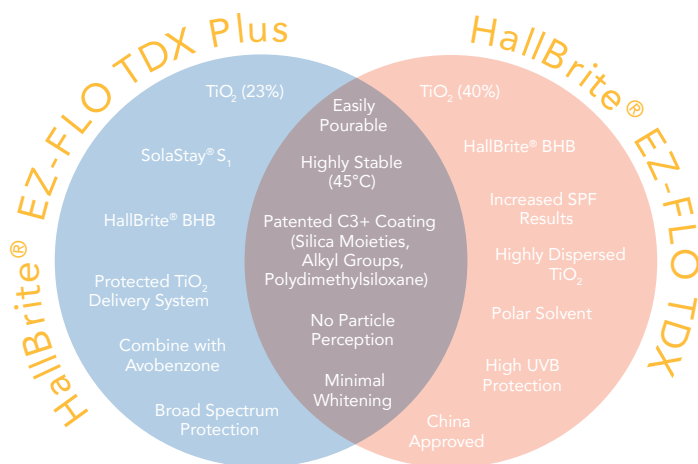


LEVERAGING A NEW PATENTED COATING SYSTEM AND PURE PHOTOSTABILITY SCIENCE

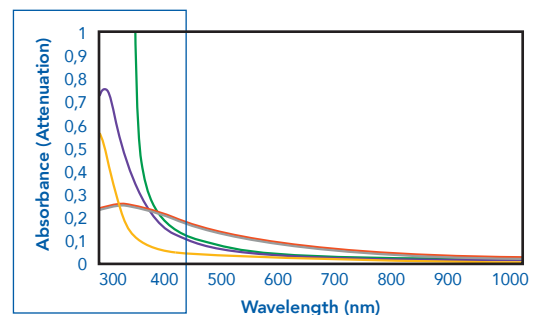
Metal oxides with a wide band gap, such as titanium dioxide ( $\text{TiO}_2$ ), or with a direct band gap, such as zinc oxide ( $\text{ZnO}$ ), absorb and reflect UV energy from the sun's radiation. This makes them useful as UV filters and as pigments in the cosmetic industry. Unfortunately, they are also photo-active, promoting the formation of reactive oxygen species and catalyzing the decomposition of organic materials. This is not desired in personal care applications, where the protective functions of these organic compounds are needed. Commercial surface modifications have not eliminated this degradation, so a new means of protection was needed.

Hallstar has developed UV filter dispersions highlighting both the benefits of photo-protected titanium dioxide and an industry leading mineral UV filter aesthetic. Leveraging a patent-protected C3+ coating system consisting of silica moieties (derived primarily from tetraorthosilicate), alkyl groups (derived from triethoxycaprylylsilane) and polydimethylsiloxane

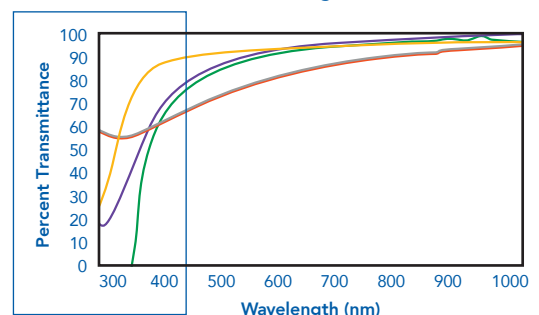
(derived from dimethiconol) with our market leading photostabilizer technology, SolaStay® S<sub>1</sub> (ethylhexyl methoxycrylene) and HallBrite® BHB (butyloctyl salicylate), we've introduced to the market how mineral UV filters can be easy to work with and also result in nice feeling, low whitening, high performance sunscreens for customers.



**Absorbance Spectra of UV Filter Concentrates:**  
0.001% Active  $\text{TiO}_2$  Diluted in C12-15 Alkyl Benzoate  
1 cm Path Length



**Transmittance Spectra of UV Filter Concentrates:**  
0.001% Active  $\text{TiO}_2$  Diluted in C12-15 Alkyl Benzoate  
1 cm Path Length



■ HallBrite® EZ-FLO TDX Plus    ■ HallBrite® EZ-FLO TDX  
■ Competitor A    ■ Competitor B    ■ Competitor C



Drawdowns of dispersions diluted in C12-15 alkyl benzoate. Drawdowns made using #4 Meyer rods on dark substrates. The greater whitening effect of competitor products is very apparent.

LET'S WORK WONDERS™

HALLSTAR

# HIGH PERFORMING TITANIUM DIOXIDE DISPERSIONS (continued)

Formula #	JZ8-286B	JZ8-286C	JZ8-286D	JZ8-287B	JZ8-287C	JZ8-287D
<b>Oil Phase Ingredients (%)</b>						
C12-C15 alkyl benzoate	30.00	25.00	20.00	30.00	25.00	20.00
HallBrite® EZ-FLO TDX Plus	10.00	15.00	20.00	-	-	-
HallBrite® EZ-FLO TDX	-	-	-	10.00	15.00	20.00
Cetearyl alcohol	0.50	0.50	0.50	0.50	0.50	0.50
VP/Eicosene copolymer	1.00	1.00	1.00	1.00	1.00	1.00
Potassium cetyl phosphate, hydrogenated palm glycerides	2.00	2.00	2.00	2.00	2.00	2.00
Glyceryl stearate	1.35	1.35	1.35	1.35	1.35	1.35
PEG-100 Stearate	1.00	1.00	1.00	1.00	1.00	1.00
<b>Water Phase Ingredients (%)</b>						
Water	48.25	48.25	48.25	48.25	48.25	48.25
Disodium EDTA	0.05	0.05	0.05	0.05	0.05	0.05
Xanthan gum	0.25	0.25	0.25	0.25	0.25	0.25
Glycerin	3.00	3.00	3.00	3.00	3.00	3.00
Caprylyl glycol, phenoxyethanol, hexylene glycol	0.60	0.60	0.60	0.60	0.60	0.60
Acrylamide/sodium acryloyldimethyltaurate copolymer, isohexadecane, polysorbate 80	2.00	2.00	2.00	2.00	2.00	2.00
<b>TOTAL (%)</b>	100.00	100.00	100.00	100.00	100.00	100.00
<b>Average SPF (in vitro)</b>	<b>9</b>	<b>13</b>	<b>21</b>	<b>14</b>	<b>21</b>	<b>32</b>
<b>Critical Wavelength (CW), nm</b>	<b>374</b>	<b>377</b>	<b>377</b>	<b>373</b>	<b>373</b>	<b>373</b>

