



ALUMINA TRIHYDRATE



## SpaceRite® S-3 Alumina Trihydrate (ATH)

Optimizing the Cost and Performance of  
100% Active, UV Cure Inks and Coatings

### The Challenges

Regulatory concerns over air quality and a never-ending drive for higher performance has led to an increasing usage of UV cure systems for inks, coatings and wood-fillers. These systems are well-known for high gloss and durability, but they are often more expensive than other types of coating chemistry.

Using mineral fillers is a common way to lower the cost of coatings containing water or solvents. However, mineral extenders generally do not work for UV cure systems because they are not transparent to UV radiation. Some extenders hinder curing reactions by their inherent absorbance properties and, thus, limit the effective penetration depth of the UV radiation. This compromises cure efficiency and/or crosslink density, especially if the filler is capable of acting as a free radical scavenger. In pigmented systems, the difficulty is in selecting a filler that will not absorb UV energy.

Formulators of unpigmented UV cure coatings are especially limited in using extenders as most cost-effective additives will reduce the clarity of the coating and/or impart a yellow or darker cast to the coating.

## Alumina Trihydrate (ATH) is a Solution

ATH or hydrated alumina has numerous attributes that position it as a performance additive in UV cure systems:

### ATH Attributes

- Refractive Index of 1.57, which is similar to the refractive index of UV Cure Polymers
- Chemically Inert
- Water Insoluble
- Low Abrasivity
- Low Oil Absorption
- Easy to Incorporate
- Cost Effective
- Fire Retardant

### Two ATH Processes

ATH is available in a wide variety of particle sizes. There are two processes to produce ATH, which yield different particle size distributions and purity.

#### Ground ATH

- Relatively broad particle size distribution
- Lower Hegman grind readings
- Economical

#### Double Precipitated ATH

- Narrower particle size distribution/ lower surface area
- Higher purity
- Very high whiteness, brightness

## Introducing SpaceRite® S-3 Double Precipitated ATH

SpaceRite® S-3 double precipitated ATH provides outstanding clarity and transparency in UV cure applications. SpaceRite S-3 has all of the attributes listed above. The fact that it is double precipitated makes it highly desirable for use in extending UV cure coatings and inks for the following reasons:

### ✓ Unequaled Purity and Brightness

Since SpaceRite S-3 is double precipitated, its low levels of impurities mean that its brightness is greater than 99%, which is higher than the brightest grades of titanium dioxide (TiO<sub>2</sub>). Unlike mineral fillers, SpaceRite S-3 will not impart a yellow or muddy cast to the ink or coating. Whites and colors appear bright and vibrant.

### ✓ Narrow Particle Size Distribution

Normally, a mineral that is ground to one micron would have a relatively high surface area. However, the surface area of SpaceRite S-3 is only 4 m<sup>2</sup>/gram due to the small number of ultrafine particles. This means that significant loading levels can be achieved. SpaceRite S-3 also has a small coarse fraction. The lack of coarse particles results in minimal impact on gloss, and SpaceRite S-3 can be formulated in systems with a Hegman grind of 7.

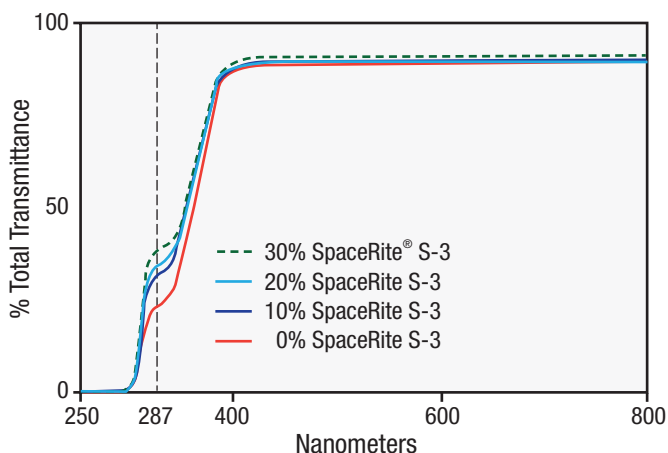
### ✓ High UV Transparency

SpaceRite S-3 has been proven to have very high UV transparency. Unlike most fillers for UV curable polymers, ATH is essentially transparent to radiation over the wavelength range which is commonly used to activate most UV photo initiators (220 to 400 nm). By choosing oligomers and other components that impart a refractive index similar to 1.57, SpaceRite S-3 can be used at loadings of up to 10% with haze values as low as 5%. In thin film applications, the level of haze is virtually indistinguishable from that of the unfilled system. Consequently, optical performance can be achieved with a resulting savings in raw material costs.

### SpaceRite® S-3 ATH Transmittance

In the study below, SpaceRite® S-3 filled systems at 10%, 20% and 30% loadings had nearly the same total transmittance from 250 nm to 800 nm compared with unfilled systems. The transmission rates actually increased in the wavelength range of 270 nm to 350 nm. Since SpaceRite S-3 ATH cannot absorb UV light, it behaves as a “spacer” of the strongly absorbing aromatic chromophores of the oligomers.

Total Transmittance for Neat and ATH Filled UV-Cured Films

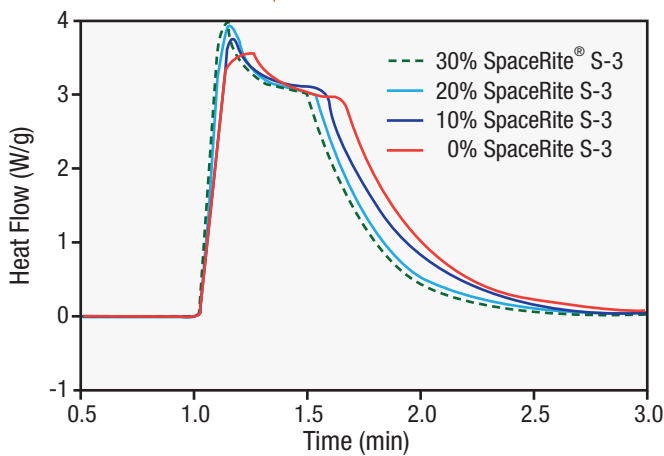


### Curing Thick Film Coatings Filled with SpaceRite S-3 ATH

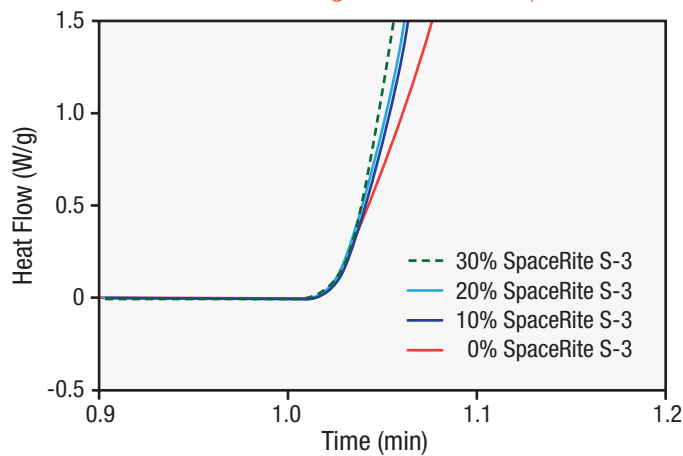
The use of SpaceRite S-3 has been shown to increase the rate of cure for UV cure systems at high film thicknesses. In a study comparing cure rates of a cast film of 2 mm in thickness, differential photocalorimetry (DPC) was used to measure cure enthalpy, which correlates to cure rate.

The graphs below demonstrate that increasing the loading level from 10% to 30% of SpaceRite S-3 ATH result in higher cure enthalpy (faster cure rates) for a 2 mm film.

Influence of ATH Loadings on Thick Films Exposed for Five Minutes



Influence of ATH Loadings on the Initial Cure of Thick Films (Magnified from Graph at Left)



The data in the three charts presented on this page were generated in side-by-side testing of one sample of each product.



**SpaceRite® S-3 ATH: The UV Cure Filler Choice**

In summary, SpaceRite® S-3 is recommended as an extender in the following UV cure applications to lower the cost of these systems without sacrificing color, durability or gloss:

- Clear UV cure coatings and overprint varnishes
- White UV coatings and inks
- Pastel to deep tone UV coatings and inks
- Thicker UV cure systems to improve the cure rate



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For more information on SpaceRite S-3 or to order product samples, contact us today:

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## Credits / References

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