

NUOSPERSE[®] FX 7500W

Application Leaflet

High performance polymeric dispersing agent for aqueous coating systems

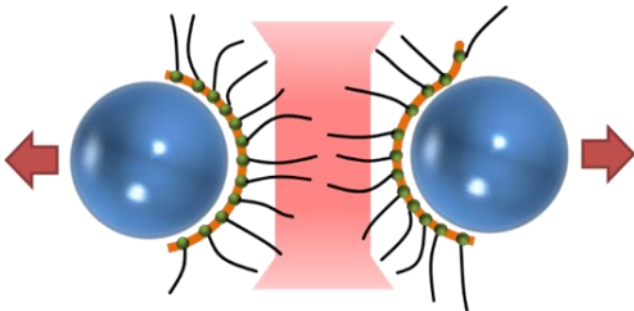


Key Benefits

- ❖ Effective wetting of inorganic and organic pigment, especially carbon black
- ❖ Efficient reduction of grinding time and millbase viscosity
- ❖ Low foaming

Introduction

NUOSPERSE® FX 7500W is a high molecular weight dispersing agent developed for low VOC, aqueous pigment dispersions, coatings and inks. NUOSPERSE® FX 7500W has been based on a branched copolymer with multiple pigment anchoring groups. The polymer side chains reaches into water phase and provide a steric barrier, thus ensuring high flocculation resistance and stabilization of the pigment particles (*Figure 1*). The results are enhanced pigment wetting, dispersing and stabilization, lower mill base viscosities, increased color intensity of organic and inorganic pigments dispersions and wide resin compatibility.



NUOSPERSE® FX 7500W has been dedicated for aqueous pigment pastes and concentrates, water-based general industrial coatings, architectural coatings, automotive coatings, wood and furniture coatings, printing inks, can and coil coatings, leather finishes, protective coatings, etc. NUOSPERSE® FX 7500W works particularly well with most types of carbon blacks, organic and inorganic pigments such as phthalocyanine blue, organic red, TiO₂, iron oxides, etc.

Product features

- ◆ Effective wetting and dispersion of inorganic, organic and carbon black based pigments
- ◆ Efficient grind time reduction
- ◆ Strong reduction of the millbase viscosity
- ◆ Prevents pigment reflocculation and provides consequently excellent storage stability
- ◆ Low foaming
- ◆ Imparts excellently the following properties
 - ⇒ Flowability
 - ⇒ Color development
 - ⇒ Gloss
 - ⇒ Hiding power

Product details

Composition	Aqueous solution of high molecular weight copolymer with multiple anchoring points
Appearance	Yellow/brownish liquid
Non-volatile content [%]	40
Solvent	water
Acid number [mg KOH/g]	~1.0

Technical details

In a first test series performed in resin free pigment concentrates for coatings and inks equipped with various carbon black pigments, NUOSPERSE® FX 7500W has been working exceptionally well.

In *Figure 2* the influence of NUOSPERSE® FX 7500W on the viscosity and the storage stability of carbon black dispersions in comparison to a commercially available market reference product is shown.

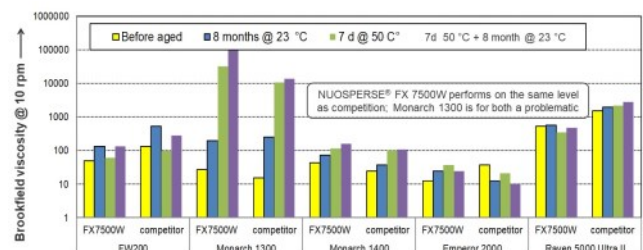


Figure 2: Viscosity over storage

It is evident that NUOSPERSE® FX 7500W showed robust wetting and dispersing performance and provided good storage stability of the carbon black pastes after heat-aged storage indicating excellent flocculation resistance of the pigment particles.

The excellent performance of NUOSPERSE® FX 7500W in terms of jetness development and compatibility is illustrated in *Figure 3*. The shown test panels display clear base coatings based on acrylate emulsion and polyurethane binder emulsions equipped with the above displayed carbon black concentrates.



Figure 3: Jetness and compatibility

The versatility of NUOSPERSE® FX 7500W can also be seen other pigment dispersion systems based on inorganic and organic pigments. The following data table (Figure 4) is showing the viscosity variations (after heat-aging at 50°C for 7 days) of pigment dispersions utilizing phthalocyanine blue, carbon black, titanium dioxide and iron oxide yellow.

	NUOSPERSE® FX 7500W	Market reference 1	Market reference 2
Brookfield viscosity change after aging at 50°C			
Heliogen blue 7079 37% (D/P 65%)	-22.7	-23.5	-30.2
Carbon black MA100 35% (D/P 50%)	-2.7	+55.4	-2.6
Titaniumdioxide R 706 72% (D/P 15%)	-8.9	-11.2	35.7
Iron oxide yellow 55% (D/P 25%)	-21.4	-44.1	-23.8

Figure 4: Viscosity aging stability

All the tested samples showed some viscosity variations after the aging period. However, NUOSPERSE® FX 7500W displayed the lowest variations and therefore the best stability compared to the market references tested.

Colour development

Adding into the initially described clear bases resulted in a good colour development, excellent compatibility and superb gloss development. The drawdown shown below in Figure 5 are representing the results of the phtalocyanin based colorant in the base coat with 3% pigment loading.

	Market reference 1		Market reference 2		NUOSPERSE® FX 7500W	
	Initial	Aged	Initial	Aged	Initial	Aged
	Lightness L*	-46.1	-45.8	-45.3	-45.4	-45.7
Gloss 60°C	57.6	55.2	54.0	56.9	59.5	57.1

Figure 5: Phtalocyanin blue / PU clear base

It can be seen that the samples containing NUOSPERSE® FX 7500W provide excellent colour strength and stability on aging. Even better results were noticed with NUOSPERSE® FX 7500W in terms of gloss development. The initial values are noticeably higher than with both market reference products. Also the gloss stability on storage was very good.

The drawdowns displayed in Figure 6 are showing the results of the clear base equipped with the iron oxide

yellow paste in an acrylic clear base at a total pigment loading of 20%.

	Market reference 1		Market reference 2		NUOSPERSE® FX 7500W	
	Initial	Aged	Initial	Aged	Initial	Aged
	Yellow b*	51.7	52.9	52.9	53.1	53.8
Gloss 60°C	79.6	83.1	80.8	78.6	82.4	74.6

Figure 6: Iron oxide yellow 7 acrylic clear base

NUOSPERSE® FX 7500W provides slightly better colour development than both tested market reference grades. Also the colour stability over aging is excellent. Gloss values are NUOSPERSE® FX 7500W are in line with the the market references.

In Figure 7, it was observed that the acrylic clear base tinted with the titanium dioxide (pigment loading 25%) based white paste showed significantly higher lightness (L*) and gloss values than the samples with both of the screened market references.

	Market reference 1		Market reference 2		NUOSPERSE® FX 7500W	
	Initial	Aged	Initial	Aged	Initial	Aged
	Lightness L*	90.8	91.2	91.4	91.6	92.9
Gloss 60°C	46.0	45.0	48.0	47.1	70.0	75.0

Figure 7: Titanium dioxide white / acrylic clear base

In the following test series, the phtalocyanin blue and carbon black based pigment paste were mixed with an acrylic white base coating to produce grey and blue color shades.

In the subsequent Figure 8, the lightning data L* and the Delta E values of the rub-out areas of the carbon black paste equipped system has been visualized.

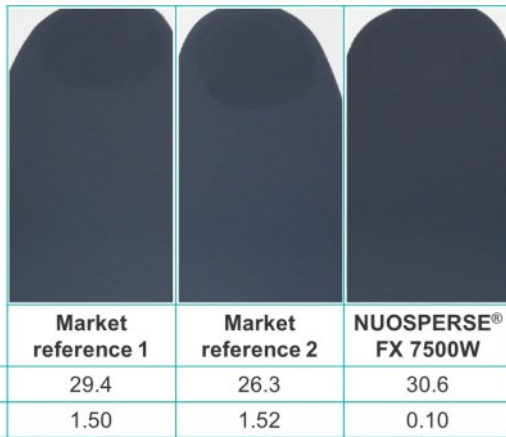


Figure 8: Colour development & delta E

The sample equipped with NUOSPERSE FX 7500W displayed visually the best colour development. Also the rub out area is underlining the beneficial compatibility.

The colour values L* confirmed these excellent findings. The delta E value visualized the smallest colour difference with the tested samples.

In the following Figure 9, the phthalocyanine blue colorant has been added to the acrylic white base.

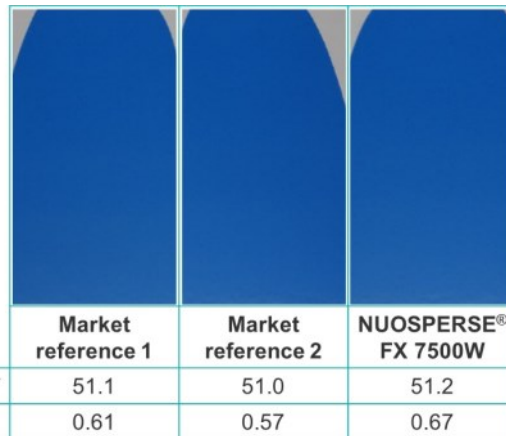


Figure 9: Colour development & delta E

Also in the case of blue tinted acrylic white base, the sample with NUOSPERSE® FX 7500W performed in terms of colour development and the colour acceptance perfectly in line with the both tested market reference grades.

However, in addition to the application in variously coloured topcoats, NUOSPERSE® FX 7500W performs also excellently in other systems. As an example, a water borne epoxy primer was selected. In the following Figure 10, the influence of NUOSPERSE® FX 7500W on the viscosity stability and the shear thinning behaviour (7 days; 50°C) is visualized. To display the shear thinning strength the so called shear thinning index (STI) was taken. The STI is the factor out of the Brookfield viscosity measured at 10 rpm and at 100 rpm. The higher the

value the stronger shear thinning does the sample act.

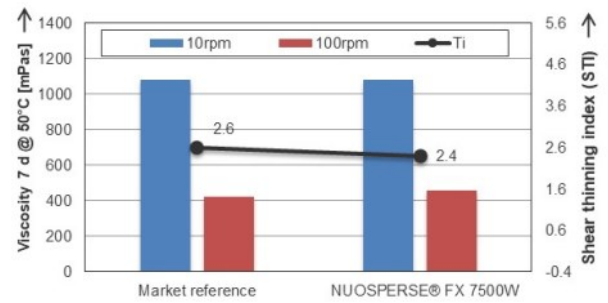


Figure 10: Viscosity and STI epoxy primer

It becomes visible that both of the tested samples are performing very similar in terms of the viscosity stability. Also the shear thinning character of the samples remains unaffected by the change of the dispersants.

Another important fact beside the viscosity stability on storage is the general stability of the sample. In Figure 11 the vessels with the primer directly after taking from the heat storage are shown.

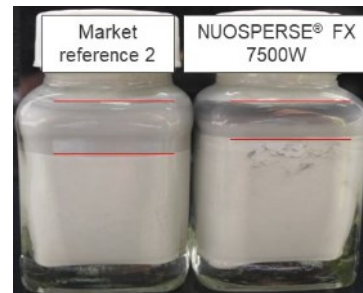


Figure 11: Syneresis after storage/epoxy primer

The sample formulated with NUOSPERSE® FX 7500W shows less syneresis layer in comparison to the material manufactured with the market reference dispersant.

Further the effect of the different dispersants on the corrosion prevention after storage at high humidity is of high importance. In Figure 12 two panels coated with the epoxy primer are displayed after storage at high humidity (40°C/100%/300h) can be found.



Figure 12: Corrosion prevention at high humidity

It becomes obvious that in terms of corrosion prevention both samples are performing equally good.

Foaming

Owing a unique molecular structure, NUOSPERSE FX 7500W possesses a low foaming behavior in two colour pastes (organic red and phthalocyanine green). This has been visualized in the below *Figure 13*.

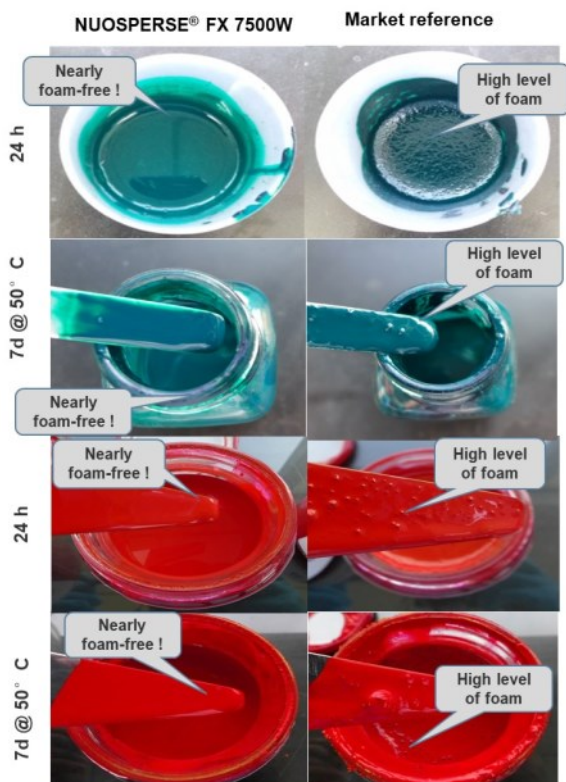


Figure 13: Foaming

In both colorants the beneficial behaviour after the milling of NUOSPERSE® FX 7500W in comparison to a market reference can be observed. It offers here a clear benefit in terms of low foaming and flowability.

Conclusion

NUOSPERSE® FX 7500W is a versatile polymeric wetting and dispersing agent that is well suited for all pigment types. It works particularly well with high color carbon blacks and gives high blackness and jetness values. Pigment dispersions and colorants formulated with NUOSPERSE® FX 7500W show low viscosity, good storage stability, excellent color properties, good compatibility with multiple bases, and low foaming.

NUOSPERSE® FX 7500W enables the formulation of resin-free and resin-minimal pigment dispersions of high pigment loading and ensures an efficient grinding process and shorter cycle time. The dispersant is also applicable for various waterborne industrial coatings such general industrial coatings, direct-to-metal (DTM), architectural coatings, automotive coatings, wood and furniture coatings, printing inks, can and coil coatings, leather finishes, protective coatings, etc.

Appendix

Formulations

Carbon black based colorants

Loading [%]	Evonik FW 200	Monarch 1300	Monarch 1400	Emperor 2000	Raven 5000
Pigment	15.0	15.0	18.0	18.0	20.0
Dispersant	22.5	16.5	22.5	21.6	30.0
Defoamer	0.3	0.3	0.3	0.3	0.3
Preservative	0.1	0.1	0.1	0.1	0.1
DMAE	1.0	1.0	1.0	1.0	1.0
Water	61.1	67.1	58.1	59.0	48.6

Clear base coatings

Component	PU based topcoat [%]	Acrylic top coating [%]
PU based binder emulsion	74.0	--
Acrylic binder emulsion	--	72.0
DeminerIALIZED water	19.1	19.2
SUPREAD® 2059	0.3	0.3
RHEOLATE® 299	--	0.3
RHEOLATE® 658	1.1	--
Butylglycol	--	4.0
Butyldiglycol	--	4.0
Ethylene glycol monobutyl ether	5.3	--
Preservative	0.2	0.2
Total	100.0	100.0

Colorant formulations

Loadings [%]	Carbon black MA 100	Hellogen Blue D 7079 Phthalocyanin	Ti-Pure R 706	Bayferrox 3920
Pigment	35.0	37.0	72.0	55.0
Dispersant	17.5	24.0	10.8	19.3
Defoamer	0.1	0.3	0.1	--
Preservative	0.1	0.1	0.2	0.2
DMAE	0.3	--	--	--
Propylene glycol	4.0	--	--	--
Water	43.0	38.6	16.9	25.4

Blending guideline

35% Carbon Black – MA100
D/P=50.0% (wt%)

37% Hellogen® Blue D 7079
D/P=64.9% (wt%)

72% Ti-Pure™ R-706
D/P=15.0% (wt%)

55% Iron Oxide Yellow
Bayferrox® 3920
D/P=25.0(wt%)

Acrylic clear base
Dedicated for plastic

PU based clear base
Dedicated for wood

3% pigment loading --Carbon Black MA 100
3% pigment loading --Hellogen® Blue D 7079
25% pigment loading --Ti-Pure™ R-706
20% pigment loading -- Iron Oxide Yellow, Bayferrox® 3920
25% pigment loading --Ti-Pure™ R-706
Tinted with 3 % Carbon Black MA 100
Tinted with 3 % Hellogen® Blue D 7079

Colorant formulations foaming tests

	NUOSPERSE® FX 7500W	Market reference
Water	51.8	51.8
Dispersant(s)	18.0	18.0
Phthalocyanine green pigment/ Naphthol Red 170	30.0	30.0
DAPRO® DF 696	0.2	0.2
Total	100.0	100.0
Pigment, %	30.0	30.0
D/P, %	60.0	60.0

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North America

Elementis
469 Old Trenton Road
East Windsor,
NJ 08512, USA
Tel:+1 609 443 2500
Fax:+1 609 443 2422

Europe

Elementis UK Ltd.
c/o Elementis GmbH
Stolberger Strasse 370
50933 Cologne, Germany
Tel:+49 221 2923 2066
Fax:+49 221 2923 2011

Asia

Deuchem (Shanghai) Chemical Co., Ltd.
99, Lianyang Road
Songjiang Industrial Zone
Shanghai, China 201613
Tel:+86 21 5774 0348
Fax:+86 21 5774 3563