MÜNZING
CREATING ADDITIVE VALUE

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METOLAT® 360 / 365

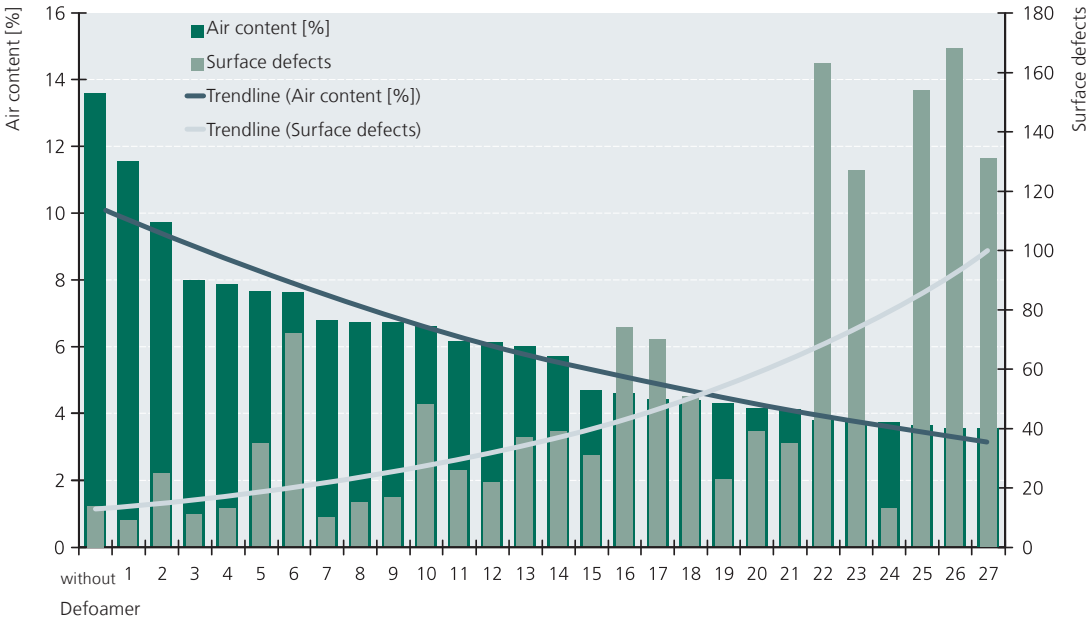
Multifunctional low foaming wetting agents

To meet highest demands it is necessary to harmonize the additives with the used binders in modern coatings, inks and adhesives. This is specifically important for the selection of wetting agents and defoamers.

In particular adequate effective defoamers are often incompatible. They separate from the system during storage, lead to coagulation of binders or create levelling defects, e.g. orange-peel, craters or fish eyes. Ideally it is possible to identify a suitable defoamer empirically (e.g. defoamer 24 in figure 1). But in some cases even with extensive lab tests no defoamer can be determined which is effective enough and does not cause any undesired effects. Then a suitable wetting agent is required which eliminates the defects without affecting the defoamer performance to achieve a processable system.

Especially in clear coats, adhesives, overprint varnishes and low viscosity systems the wetting agents METOLAT® 360 and METOLAT® 365 have proven synergistic effects in combination with many defoamers. In water based printing inks METOLAT® 360 and METOLAT® 365 can act as a defoamer and wetting agent in one.

Figure 1
Defoamer efficiency vs. compatibility



Product composition & Properties

METOLAT® 360 and METOLAT® 365 are nonionic, silicone free wetting agents. Their special compositions lead to low static and dynamic surface tensions at low or even no foam formation. Table 1 provides the characteristics of both wetting agents.

Tabelle 1
Characteristics of METOLAT® 360 and METOLAT® 365

	METOLAT® 360	METOLAT® 365
Appearance	yellowish clear, liquid	yellowish clear, liquid
Active content (% by weight)	approx. 95	approx. 95
Density [g/cm³]	approx. 1.0	approx. 1.0
Viscosity [mPa·s]	approx. 60	approx. 50
pH (2% in dist. water)	approx. 6	approx. 6
Solubility in water	partially soluble, emulsifiable	insoluble, hardly emulsifiable
Static surface tension	0.1% = 26 mN/m	0.1% = 26 mN/m
Dynamic surface tension	1Hz 0.1% = 26 mN/m 0.5% = 25 mN/m 10Hz 0.1% = 45 mN/m 0.5% = 31 mN/m	1Hz 0.1% = 27 mN/m 0.5% = 26 mN/m 10Hz 0.1% = 44 mN/m 0.5% = 31 mN/m

Mechanism of action

Wetting and levelling agents are additives which are interfacial active. Interfaces appear between a coating (paint, adhesive, printing ink etc.) and its respective substrate as well as between a liquid phase and the solid components of a formulation (pigments, binders, waxes etc.) or between a liquid phase and air. Thereby it applies that a liquid always wets a substance when its surface tension is below the surface tension of the substance. Vice versa this means that the liquid retreats from the interface if its surface tension is higher than the surface tension of the substance. Thus a substrate is only wetted when the coating has a lower surface tension and a formulation is only stable when all components are wetted by the liquid phase. If both requirements are not fulfilled this results in e.g. craters, fish eyes, orange peel, specks or pigment flocculation on the applied film (figure 2).

Figure 2
Fish eyes [A]
Orange peel [B]
Cissing [C]

In other words the function of a wetting agent is to move to the respective interface and to transmit the wetting component a lower surface tension opposite to the component which shall be wetted. This means that the wetting agent molecules have to move to the interface which additionally introduces a time factor. However the mobility does only play an important role if interfaces have to be wetted very fast, e.g. the print roll by the inks during printing or if a stable coating curtain has to be formed in a cast process (interfaces: coating/air and coating/lateral curtain track).

Hence a complete characterization of a wetting agent should comprehend not only the static surface tensions at different concentrations but also the dynamic surface tensions. Since the measurements of surface tensions are relatively time consuming due to the very sensitive measurement methods it is often easier and faster to carry out application tests.

Test results

Pressure sensitive adhesive

Pressure sensitive adhesives are adhesives which are applied on one or both parts which shall be bonded whereby the materials will be connected only after drying of the adhesive. In previous tests AGITAN® 299 has been identified as a proper defoamer. Partly the efficiency of the defoamer is even increased by levelling agents but then substrate wetting is affected. In this case AGITAN® 299 and METOLAT® 360 is the optimal combination which provides good deaeration, film defoaming and substrate wetting.

50g acrylate emulsion + defoamer + wetting agent	Dosage [%]	Dissolver test (foam immediately / after 1 min) [%]	Roller application	Levelling 24 µm on PP-film
without additives	–	230/230	6	9
AGITAN® 299	0.3	30/30	7	1
AGITAN® 299/EDAPLAN® LA 411	0.3/0.3	10/10	9	1
AGITAN® 299/METOLAT® 360	0.3/0.3	40/40	9	9
AGITAN® 299/METOLAT® 365	0.3/0.3	40/40	7	7
AGITAN® 299/METOLAT® 388	0.3/0.3	20/20	8	2

Table 2
Test results
Pressure sensitive adhesive
visual rating:
1–10 (top grade = 10)

Dispersion adhesive applied by cast process

In this adhesive applied by cast process the foam formation in the backflow of the material shall be minimized and the substrate wetting shall be improved. Without any defoamer the adhesive shows a poor substrate wetting and a moderate foaming in a recirculation test. The sole addition of a defoamer reduces foaming but does not improve substrate wetting. A combination of AGITAN® 299 and METOLAT® 365 results in the optimal compromise between defoaming and substrate wetting.

95g adhesive + 5g dest. Wasser + defoamer + wetting agent	Dosage [%]	Recirculation test foam volume [ml]		Levelling 24 µm on Uniset-paper		
		volume foam layer (after 10 min)	volume foam layer (after 1 min pump off)	over-all	CR	OP
ohne Additive	–	40 ml	10 ml	2	m	n
AGITAN® 282	0.3	20 ml	0 ml	2	m	n
AGITAN® 282/METOLAT® 360	0.3/0.3	5 ml	0 ml	7	s	n
AGITAN® 282/METOLAT® 365	0.3/0.3	10 ml	5 ml	7	s	n
AGITAN® 299	0.3/0.3	20 ml	0 ml	1	m	n
AGITAN® 299/METOLAT® 360	0.3/0.3	15 ml	10 ml	9	f	n
AGITAN® 299/METOLAT® 365	0.3/0.3	15 ml	5 ml	9	f	n
AGITAN® 760	0.3/0.3	5 ml	0 ml	2	m	n
AGITAN® 760/METOLAT® 360	0.3/0.3	35 ml	5 ml	5	s	n
AGITAN® 760/METOLAT® 365	0.3/0.3	20 ml	5 ml	5	s	n

Table 3
Test results Dispersion adhesive
visual rating: 1–10 (top grade = 10)
CR = crater
OP = orange peel
n = none
f = few
s = some
m = many

Acid-curing coating for decor paper

An acid-curing coating system is used as topcoat on the top layer of a decor paper for HPL-boards (high pressure laminate board). In this low viscous unpigmented coating system all effective defoamers cause more or less strong wetting problems. A combination of AGITAN® 265 and METOLAT® 360 can be trouble-free applied whereby the wetting agent even improves the defoaming effect.

70 g coating + 7.0g hardener + 3.5g dist. water + defoamer + wetting agent	Dosage [%]	Air content [%]	Levelling 36 µm on PVC-film			Levelling 36 µm on decor paper (wood-motive)		
			over-all	CR	OP	over-all	CR	OP
without additives	–	10.3	7	f	n	10	n	n
AGITAN® 218	0.5	4.9	1	m	m	2	s	m
AGITAN® 265	0.5	5.0	4	s	s	10	n	n
AGITAN® 265/METOLAT® 360	0.5/0.2	4.6	6	n	f	10	n	n
AGITAN® 299	0.5	5.1	2	m	s	4	s	n
AGITAN® 315	0.5	3.9	3	s	m	3	f	m
AGITAN® 351	0.5	3.6	3	s	m	5	s	n
AGITAN® 655	0.5	3.4	2	s	m	2	s	m
AGITAN® 731	0.5	7.5	2	m	s	4	s	n
DEE FO® PI-75	0.5	5.4	1	m	m	1	m	m

Tabelle 4
Test results Acid-curing coating
visual rating: 1–10 (top grade = 10)
CR = crater
OP = orange peel
n = none
f = few
s = some
m = many

Overprint varnish (OPV) on synthetic leather

A PVC coated fabric shall be furnished with a top coat. The clear coat is applied by flexo printing. Preliminary tests showed that most of the wetting and levelling agents cause incompatibilities or binder coagulation in this formulation.

Only METOLAT® 360 and EDAPLAN® LA 403 are compatible with the system. Furthermore AGITAN® 760 is the most efficient defoamer. Over all the combination of METOLAT® 360 and AGITAN® 760 shows the best results.

clear coat + wetting agent + defoamer	Dosage [%]	Dissolver test (foam immediately / after 1 min) [%]	Stability after 24 h	Roller application	Levelling 12 µm on PVC on textile		
					over-all	CR	OP
without additives	–	180/180	homogeneous	3	10	n	n
METOLAT® 360	0.3	170/160	homogeneous	3	10	n	n
AGITAN® 760	0.3	10/0	homogeneous	10	7	f	n
METOLAT® 360/AGITAN® 760	0.3/0.3	20/10	homogeneous	10	10	n	n
EDAPLAN® LA 403	0.3	160/150	homogeneous	3	8	f	n
EDAPLAN® LA 403/AGITAN® 150	0.3/0.3	30/30	homogeneous	10	2	m	n
EDAPLAN® LA 403/AGITAN® 760	0.3/0.3	20/10	homogeneous	10	7	f	n
EDAPLAN® LA 403/DEE FO® PI-75	0.3/0.3	70/70	homogeneous	9	–	–	–

Table 5
Test results
Overprint varnish
visual rating:
1–10 (top grade = 10)
CR = crater
OP = orange peel
n = none
f = few
s = some
m = many

Flexographic ink

For a flexographic ink a more effective and price competitive additive than the so far used one is requested. This example shows that water insoluble and slightly water soluble wetting agents are able to act as defoamer and substrate wetting agent in systems containing water soluble binders or binders with predominant water soluble parts.

printing ink + wetting agent	Dosage [%]	Air content [%]	Roller application	Levelling on prepreg		
				over-all	CR	OP
without additive	–	20.95	10	10	n	n
used additive	0.5	5.42	10	2	n	m
METOLAT® 360	0.5	3.40	10	10	n	n
METOLAT® 365	0.5	2.93	10	10	n	n
EDAPLAN® LA 452	0.5	–	–	8	n	f

Table 6
Test results
Flexographic ink
visual rating:
1–10 (top grade = 10)
CR = crater
OP = orange peel
n = none
f = few
s = some
m = many

Summary

This overview of application tests shows that METOLAT® 360 and METOLAT® 365 are excellent combination partners for a wide range of defoamers.

The compatibility of mineral oil, EO/PO block copolymer and polyether siloxane based defoamers in different systems can be adjusted by the use of METOLAT® 360 and METOLAT® 365 without serious loss of defoaming efficiency.

In some cases both wetting agents exhibit outstanding wetting as well as defoaming abilities.

Further advantages are:

» low dosage level
» good compatibility
» strong reduction of dynamic surface tension
» silicone free
» improved substrate wetting and stability of the coating

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