

plastic additives from Danisco

September 2010, Bjarne Nielsen, Non-Food &
Plastics, Denmark



Danisco in a glance

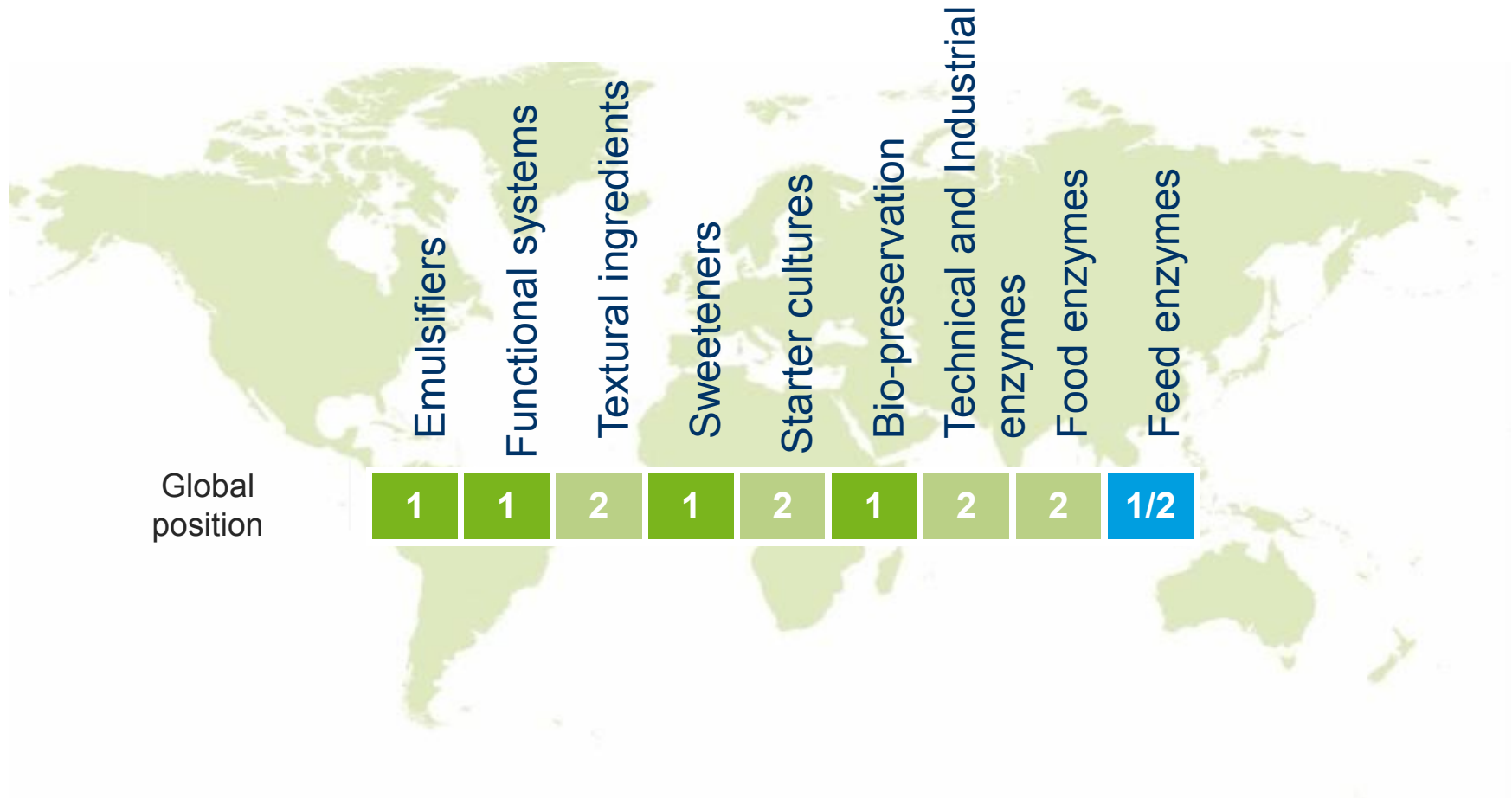


Danisco is a world leader in food ingredients, enzymes and bio-based solutions. Using nature's own materials, science and the knowledge of our 6,800 people, we design and deliver bio-based ingredients that meet market demand for healthier

- Danisco A/S founded in 1989
- Listed on the NASDAQ OMX Nordic Exchange
- Employees: approx. 6,800
- Revenue: EUR 1.8 billion/DKK 13.0 billion (2008/09)
- International presence: around 40 countries
- Headquarters: Copenhagen, Denmark
- Chairman of the Board: Jørgen Tandrup
- Chief Executive Officer: Tom Knutzen



Danisco's global position



Danisco in-side ...

.. every 4th loaf of bread



.. every 2nd ice cream



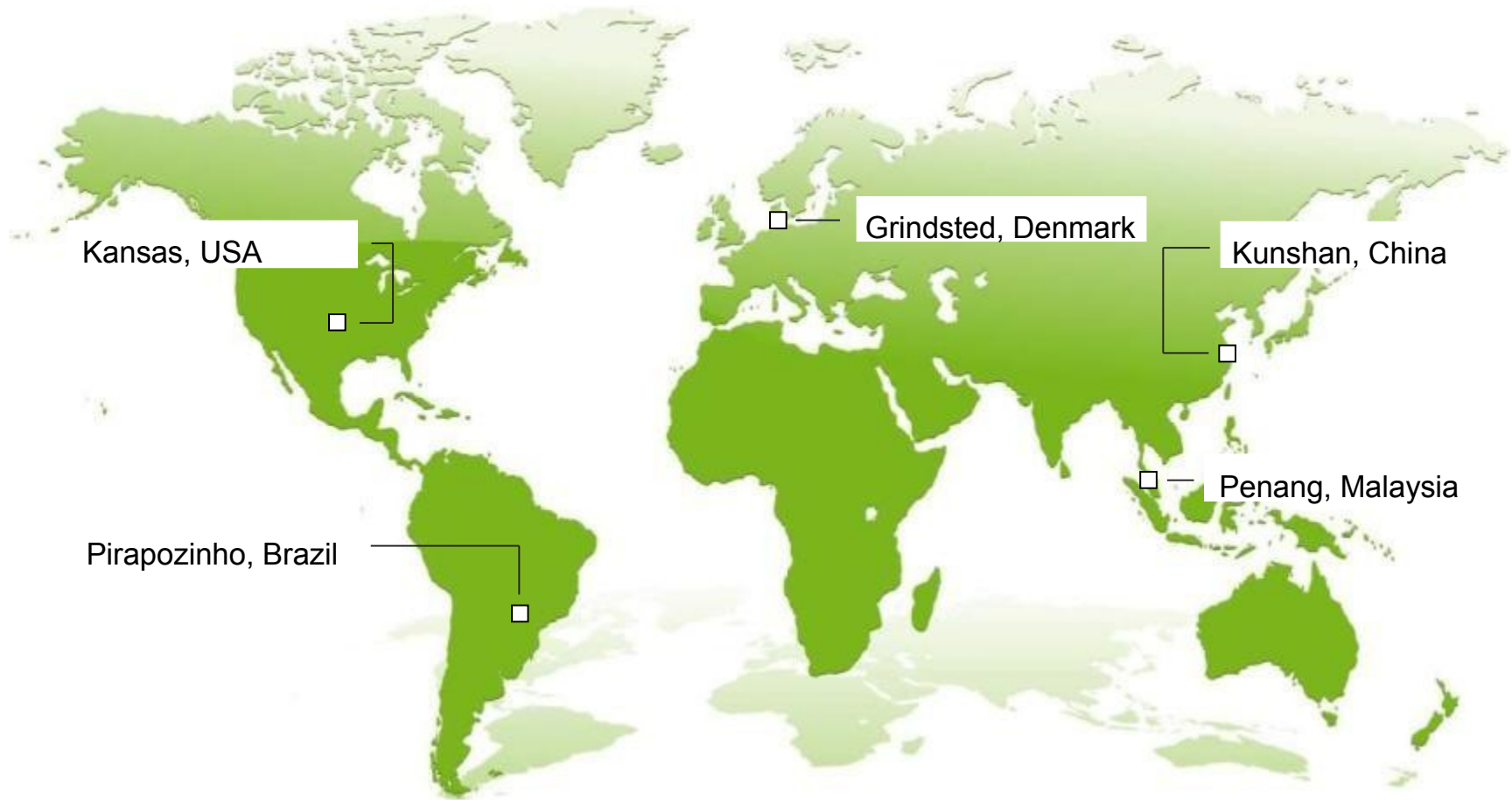
.. every 3rd cheese



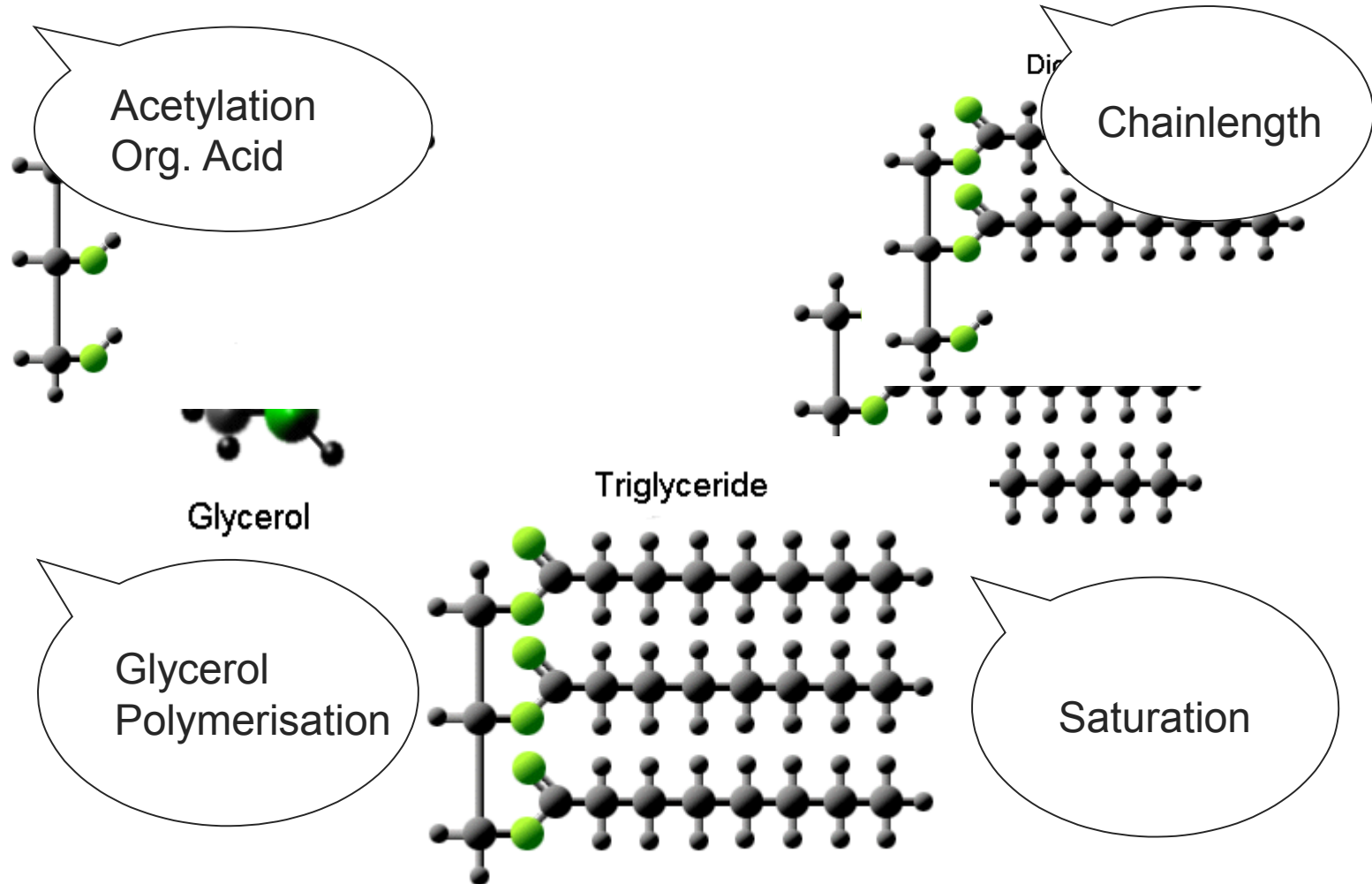
.. every 3rd box of detergent



Emulsifiers Production Sites



Chemistry



Physical Forms

... liquids



... powders



... pellets



The value proposition



INNOVATION / DIFFERENTIATION ACTIVE BRANDING

Product overview

Plastic additives from Danisco

> Antistatic and mould release agents

- Food-grade, amine/amide free additives, dissipating the electric charges, avoiding dust attraction and enhancing mould release and de-nesting

> Antifog agents

- Food-grade additives, preventing the formation of water droplets on the surface of food packaging and agricultural film applications

> Plasticizers

- Food-grade or food-contact plasticizers, turning the brittle, stiff PVC into a resin suited for soft and flexible applications



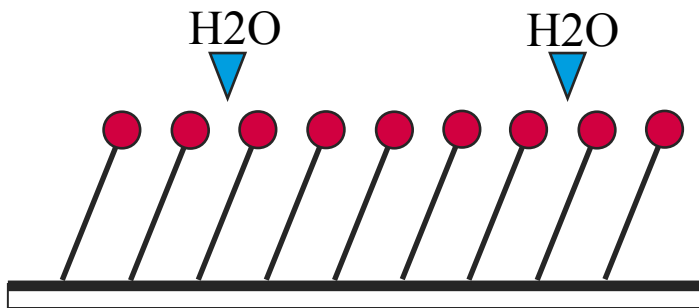
The antistat property

- An antistat must prevent static charge build-up on the polymer surface. Thus preventing dust attraction.
- The antistat will bind ambient moisture and form a conductive layer on the surface. Charge is then dissipated.
- The antistat property is most commonly measured as static decay time or as surface resistivity.

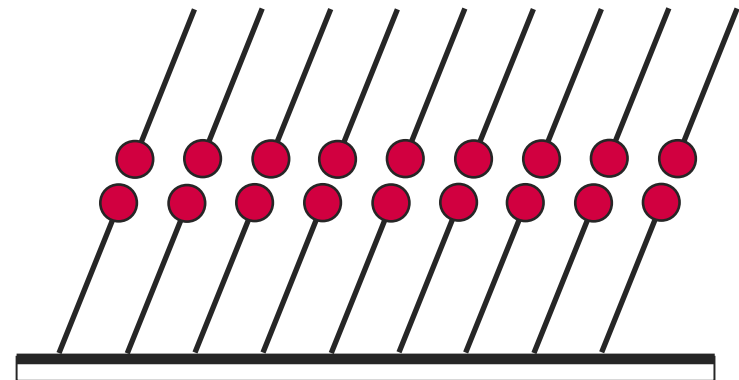


The antistat property

Monoglyceride is the active component of GMS



Monoglyceride binds water and the antistat property is established



The antistat property is lost once conditions favour a stable crystalline structure of the monoglyceride

The antistat property – an example of use



Good antistat performance

No antistat effect

The antifog property

- The function of an antifog is to prevent condensation of water vapour as small water droplets on the film surface
- The anti-fog reduces the surface tension at the water/polymer interface – condensed water is a thin continuous film and there is no loss of transparency
- A cold fog test is the industry standard for evaluation of antifog properties

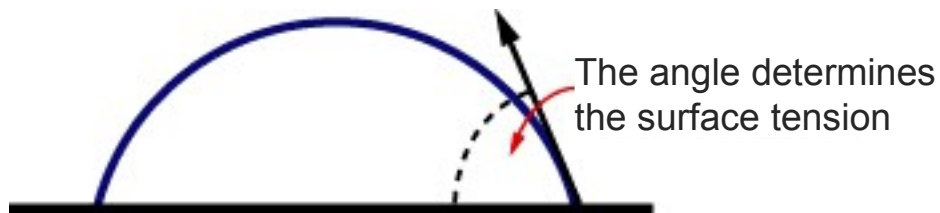


Excellent
Rating A

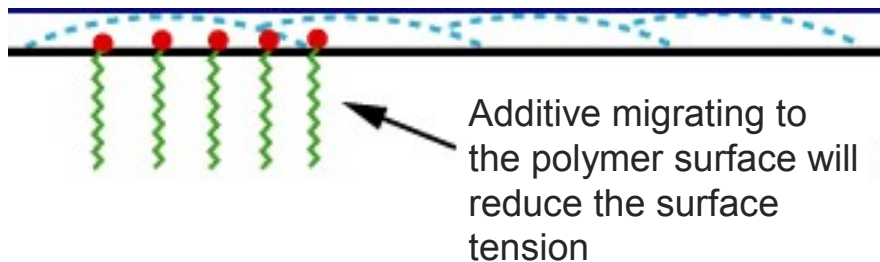
Lacking
performance
Rating B-C

Not
acceptable
Rating D-E

The antifog property



- > With no antifog added, the film surface will have a high surface tension
- > Water will settle as droplets



- > A good antifog will reduce the surface tension significantly
- > Water will settle as a thin continuous film

Antistats for PE film applications



GRINDSTED® PGE 308 is the perfect antistat for electronic packaging applications

- > Excellent antistat performance at low humidity
- > No risk of stress corrosion cracking in amorph polymers

Additive	Level [%]	Day 1	Day 3	Day 14	Day 56	Day 112	Day 224	Day 448
PGE 308	0.4	4.4	4.9	3.3	1.7	2.0	1.7	1.3
	0.6	4.5	3.6	2.4	2.2	2.4	1.4	1.1
	0.8	4.8	3.4	1.5	1.3	1.0	0.9	0.9
LADA	0.4	38.7	10.3	1.5	1.1	0.7	0.9	0.6
	0.6	1.1	0.9	0.4	0.3	0.3	0.3	0.2
	0.8	0.5	0.4	0.2	0.2	0.2	0.2	0.1

Performance is measured as static decay time.

Results recorded in a 50 μ m blown LLDPE film at 12% relative humidity.

Excellent antistat performance in food packaging film

- Food grade additive with worldwide approval for use in food contact applications
- Based on chemistry completely free of amines and amide

Additive	Level [%]	Day 1	Day 7	Day 14	Day 28	Day 56	Day 112	Day 196
PGE 308	0.10	0.46	0.26	0.39	0.85	0.35	0.18	0.14
	0.20	1.47	0.36	0.21	0.30	0.26	0.38	0.09
	0.40	0.71	0.67	0.45	0.47	0.31	0.33	0.03
Ethox. Amine	0.10	nef	nef	3.6*	0.4*	0.11	nef	0.1*
	0.15	nef	1.1*	0.6*	0.1*	nef	nef	0.03
	0.20	nef	0.2*	nef	2.5*	nef	nef	0.2*
nef is no antistat effect. * indicates that antistat performance is inconsistent and not reproducible								

Performance is measured as static decay time at 50% relative humidity

Results recorded in a 50 μ m blown LDPE film.

GRINDSTED PGE 308 – Antistat performance in HDPE injection moulding

- > Food grade additive with worldwide approval for use in food contact applications
- > PGE 308 outperforms conventional antistat recommendations
- > Consistent performance both short and long term

Additive	Level [%]	Day 1	Day 3	Day 7	Day 14	Day 28	Day 56	Day 112
GRINDSTED PGE 308	0,70	nef	nef	nef	nef	0.1*	nef	nef
	1,00	0,60	0,50	0,50	0,8	0,4	1,9	0,1
GMS 90/Ethoxylated amine (ratio 2/1)	1,00	nef	nef	nef	nef	nef	nef	nef
	1,50	0.8*	nef	nef	nef	nef	nef	nef
	2,00	0.9*	1.1*	1.9*	nef	nef	nef	nef
DIMODAN HP	1,00	nef	nef	nef	nef	nef	nef	nef
	1,25	nef	nef	nef	nef	nef	nef	nef
	1,50	4,23	3,89	2.8*	nef	nef	nef	nef

nef is no antistat effect. * indicates that the antistat performance is inconsistent and not reproducible

Performance is measured as static decay at 50% relative humidity

GRINDSTED PGE 308 – Antistat performance in HDPE film

- > Food grade additive with worldwide approval for use in food contact applications
- > Very high efficiency at low loading levels
- > Consistent performance both short and long term

Additive	Level [%]	Day 1	Day 7	Day 14	Day 28	Day 56	Day 112	Day 224	Day 448
GRINDSTED PGE 308	0.15	nef	nef	nef	nef	nef	nef	nef	nef
	0.33	2.5	0.9	1.0	0.6	0.7	0.5	0.5	0.1
	0.50	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.1
	0.70	0.3	0.3	0.4	0.4	0.3	0.2	0.4	0.1

nef is no antistat effect.

Performance is measured as static decay at 50% relative humidity

Antifog agents for PE and PP



DIMODAN® MO 90 is a very efficient antifog agent for PE

- Distilled monoglyceride based on unsaturated fatty acids.
- High purity guarantees stable production and downstream processing
- Food grade additive with worldwide approval for use in food contact applications

Days after film production	Antifog Performance in LDPE Recorded at Indicated Time Intervals (minutes)							
	1	5	10	15	30	60	120	180
1	E	E	E	E	E	E	E	E
7	E	E	E	E	E	E	E	E
28	E	E	E	E	E	E	E	E
56	E/D	E/D	E	E	E	E	E	E
112	E/D	E/D	E/D	E/D	E/D	E	E	E
448	E	E	E	E	E	E	E	E

Results are recorded in a 50μ LDPE film at a 0,20% loading.

GRINDSTED® PGE O 80 is among the very best PE antifogs on the market

- GRINDSTED® PGE O 80 is providing excellent and very reliable antifog properties in PE film
- Performance is good both in the short and long term at relative low loading levels of the antifog agent

Days after manufacture	Performance recorded at indicated time intervals [min.] film					
	1	10	30	60	120	180
1	E	E	E	E	E	E
28	E	E	E	E	E	E
448	E	E	E	E	E	E

0.2% PGE O 80 in a 50 μ m blown LDPE film

GRINDSTED® PGE 308 is the only real efficient antifog agent in 3-layer film with metallocene

➤ Additive concentration is: LDPE (0%)/HDPE (0%)/met-LLDPE (0.8%)

Additive	Film age [days]	Antifog performance recorded at indicated time intervals [min.]					
		1	10	30	60	120	180
MO 90	3	E	E	E	E	E	E
	14	E	E	D	D	D	E
	56	A	A	A	C	C	C
	112	A	A	B	C	C	C
PGE O 80	3	E	E	E	E	E	E
	14	E	E	D	D	D	D
	56	E	D	D	D	E	E
	112	A	D	D	D	D	D
PGE 308	3	E	E	E	E	E	E
	14	E	E	E	E	E	E
	56	E	E	E	E	E	E
	112	E	E	E	E	E	E

GRINDSTED® PGE 308 is excellent in laminated films with metallocene

➤ Additive conc. in coex: LDPE (0%)/HDPE (0%)/met-LLDPE (0.8%)

Additive	Laminate age [days]	Antifog performance recorded at indicated time intervals [min.]					
		1	10	30	60	120	180
MO 90	7	A	A	C	C	C	C
	14	A	A	A	A	A	A
	28	A	A	A	A	A	A
	56	A	A	A	A	A	A
PGE O 80	7	E	D	D	D	E	E
	14	E	D	D	D	D	E
	28	E	D	D	E	E	E
	56	E	D	D	D	D	D
PGE 308	7	E	E	E	E	E	E
	14	E	E	E	E	E	E
	28	E	E	E	E	E	E
	56	E	E	E	E	E	E

Antifogs in co-extruded and laminated film

- Hugely different performance among antifog additives
- Thin film sections and metallocene LLDPE requires very efficient antifogs
- The least expensive additive is not offering the best cost in use performance
- Extensive testing is required to determine optimum performance
- Adhesives used in the lamination process can have a very negative effect on additive performance
- Barrier layers in the film construction can prevent undesirable additive migration

The best antifog for Random Copolymer PP, blown film

➤ GRINDSTED® PGE 909 is an excellent performer in Random Copolymer PP film at 1% load level

Days after [min.] film manufacture	Antifog performance recorded at indicated time intervals					
	1	10	30	60	120	180
1	E	E	E	E	E	E
7	E	E	E	E	E	E
28	E	E	E	E	E	E
56	E	E	E	E	E	E
112	E	E	D	D	E	E

Results shown are obtained in a 50 μ m blown film.

Antifog performance in PP cast film

>2% GRINDSTED® PGE 909 performs very well in PP cast film

Days after [min.]	Antifog performance recorded at indicated time intervals					
film manufacture	1	5	15	60	120	180
1	A	A	B	C	C	C
7	E	E	E	E	E	E
14	E	E	D	D	D	E
56	E	D	C	D	D	E
112	E	E	C	D	D	D

Results shown are obtained in a 20 μ m cast film.

Summary

Antistats for PE and PP

PE

- Antistat:
 - GRINDSTED® PGE 308 is excellent for food packaging applications. Works very well at low humidity conditions and is ideally suited for electronic packaging applications
 - GRINDSTED PGE 308 is a safe and efficient choice for HDPE antistat applications

PP

- Antistat and mould release:
 - DIMODAN® HP is the general recommendation for PP injection moulding applications
 - DIMODAN® HPL 70 migrates rapidly in Impact Copolymer giving superior and consistent performance
 - GRINDSTED® PS 426 is a non-blooming antistat developed especially for high

Summary

Antifogs for PE and PP

PE

- Antifog:
 - DIMODAN MO 90 is the general purpose antifog for PE film.
 - GRINDSTED® PGE O80 is excellent and will be first choice for many challenging antifog applications
 - GRINDSTED® PGE 308 is superior in co-extruded and laminated food packaging film for both hot and cold fog applications

PP

- Antifog:
 - GRINDSTED® PGE 909 is an excellent performer in Random Copolymer blown film and works well in cast PP film

Summary

Plasticisers and impact modifiers for PVC and Biopolymers

PVC

- GRINDSTED® SOFT-N-SAFE
 - Food contact approved
 - Substitutes phthalate plasticisers 1:1
 - Low volatility
 - Low migration

Biopolymers

- GRINDSTED® PS 435
 - Food contact approved
 - Increases the flexibility
 - Decreases the brittleness
 - Low bleeding out

Thank you for your attention



DANISCO
First you add knowledge...