DEUREX®
THE WAX COMPANY

DEUREX® TO 80 G

TECHNICAL INFORMATION

Chemical description: Oxidized Fischer-Tropsch-wax

Applications:

PVC and other plastics
- Can be used in all U-PVC and P-PVC applications but also in C-PVC

DEUREX® oxidized Hydrocarbon waxes are the best choice of lubricants especially in combination with calcium-zinc and tin stabilizers for rigid PVC products like window profiles, technical profiles, pipes and fittings.

Properties:

Partially internal and external wax, highly effective wax
- Accelerates fusion
- Decreases torque and increases pressure
- Synergistic effect in combination with non-polar PE waxes by reduction of melt viscosity
- Useful in combination with tin stabilizers

Typical dosages:

Depending on the rheological requirements
- up to 0.5 phr in combination with calcium-zinc
- up to 1.0 phr in combination with tin stabilizers

Technical data:

Colour: Off-white
Delivery form: **DEUREX TO 80 G** = Granules

	Minimum	Maximum	Method
Drop point*:	115 °C	120 °C	LV 12 (DGF M-III 3)
Acid value*:	2 mgKOH/g	4 mgKOH/g	DIN EN ISO 2114
Viscosity (140 °C):		20 mPas	LV 2 (DIN EN ISO3104)
Penetration:		1.0 mm*10^{-1}	LV 4 (DIN 51579)
Density (23 °C):	0.94 g/cm³	0.95 g/cm³	LV 3 (DIN EN ISO 1183)

* Part of certificate of analysis

Additional lubricants:

DEUREX® E 11 K – Homopolymer PE-Wachs
DEUREX® EO 40 K – Oxidized LDPE wax
DEUREX® EO 44 K – Oxidized HDPE wax
DEUREX® T 39 K – Fischer Tropsch wax

Alternative delivery form: **DEUREX® T 3901 W** – Fischer-Tropsch-wax emulsion

DEUREX AG
Dr.-Bergius-Straße 8-12
D-06729 Elsteraue
T.:+49 (0) 03441/8 29 29 29
F.:+49 (0) 03441/8 29 29 28
info@deurex.com / www.deurex.com

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DEUREX® TO 80 G was investigated in a calcium-zinc stabilized window profile formulation containing:

- 100 phr S-PVC (k=67)
- 15 phr coated calcium carbonate, window profile grade
- 4 phr titanium dioxide, rutile, window profile grade
- 6 phr acrylic impact modifier
- 4 phr calcium-zinc stabilizer

The dry blends were mixed up to 120°C in a high speed hot mixer and cooled down to 45°C. After a relaxation time of >12 hours the dry blend was extruded on a parallel twin screw extruder KMD 35-26.
The results are summarized in chart 1.

Chart 1: Extrusion results (rheological performance and basic data of the final profile)

		0.15 phr	0.15 phr			0.15 phr			0.15 phr	
	Blank	T49 prills	TO 80 prills	TO 81 prills	TO 82 prills	TO 83 prills	TO 84 prills	TP 406	PE E 18	ox PE EO 40
Acid value of the wax (mg KOH/g)		< 1	2 - 4	5 - 10	15 - 20	25 - 30	30 - 40	48 - 52	< 1	< 19
Extrusion torque (%)	54	48	48	50	51	56	61	63	51	59
Pressures:										
M1 (bar)	20	14	14	16	22	29	31	32	20	42
M2 (bar)	175	144	148	148	159	185	207	223	173	198
M3 (bar)	282	270	275	273	278	290	302	315	281	291
M4 (bar)	273	276	279	278	279	283	290	199	261	274
Melt temperature (°C)	198,1	196,4	196,4	196,7	197,1	198,3	199,1	199,2	196,3	200,3
Output (kg/h)	28,3	26,7	28,6	28,7	28,8	29,0	29,0	28,9	28,7	29,0
DHC (min)	41	42	42	42	42	42	41	41	41	40
b*	2,8	2,5	2,5	2,5	2,6	2,8	3,0	3,1	2,7	3,2
Gloss (top)	40,4	31,3	33,4	35,8	37,0	40,9	42,6	44,2	50,0	39,0
Gloss (bottom)	38,7	29,6	31,7	34,1	35,2	39,2	40,9	42,5	41,5	25,0

Conclusions regarding oxidized FT waxes

- **low oxidized Fischer-Tropsch-waxes** can be considered mainly as external waxes
- they are close to standard FT waxes regarding their rheological behavior
- due to their external behavior, low oxidized FT waxes help to delay fusion -
  this can be mainly seen by considering the pressure built up of the sensors M1 to M3 compared to the blank
- low oxidized FT waxes are lowering the extrusion torque compared to the blank
- there might be a slight increase of output in comparison to the standard FT wax
- low oxidized FT waxes are also lowering the melt temperature compared to the blank
- therefore the b* value of the final profile is lowered in comparison to the blank
- compared to standard FT waxes low oxidized FT waxes might slightly improve the gloss
  (the gloss of the specimen of the blank is higher due to the earlier gelation and the higher melt temperature)

- **higher oxidized Fischer-Tropsch-waxes** are offering mostly the properties of internal waxes
- they are close to to oxidized LDPE waxes
- regarding their rheological behavior higher oxidized FT waxes are closer to oxidized PE waxes than to standard FT waxes
- higher oxidized FT waxes accelerate the fusion due to their behavior similar to oxidized PE waxes -
  this can be mainly seen by considering the pressure built up of the sensors M1 to M3 compared to the blank
- higher oxidized FT waxes are increasing the extrusion torque compared to the standard FT wax
- there might be a slight increase of output in comparison to the standard FT wax
- higher oxidized FT waxes are increasing the melt temperature compared to the standard FT waxes
- therefore the b* value of the final profile is increased in comparison to the standard FT waxes
- in comparison to standard FT waxes and to the blank higher oxidized FT waxes might slightly improve the gloss (this is mainly related to the earlier gelation and the higher melt temperature)

- **oxidized Ficher-Tropsch-waxes at a lower oxidation degree** are a good alternative to PE waxes
- they are keeping the stronger influence on torque at a lower dosage
- PE waxes are mainly superior regarding their influence on gloss and lower melt viscosity, though higher loads of PE wax might be necessary to adjust the same extrusion torque

- **oxidized Fischer-Tropsch-waxes at a higher oxidation degree** are a good alternative to oxidized LDPE waxes

  There might be a synergism in the combination of oxidized FT waxes and PE waxes.

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