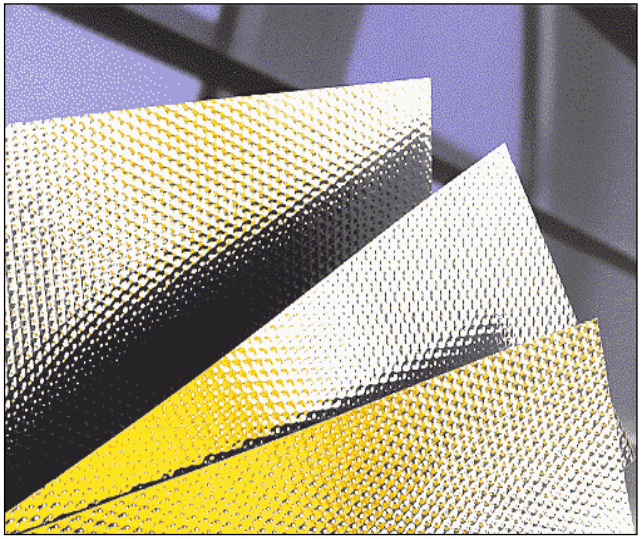
MULTIFILM®

Properties and use of MULTIFILM® films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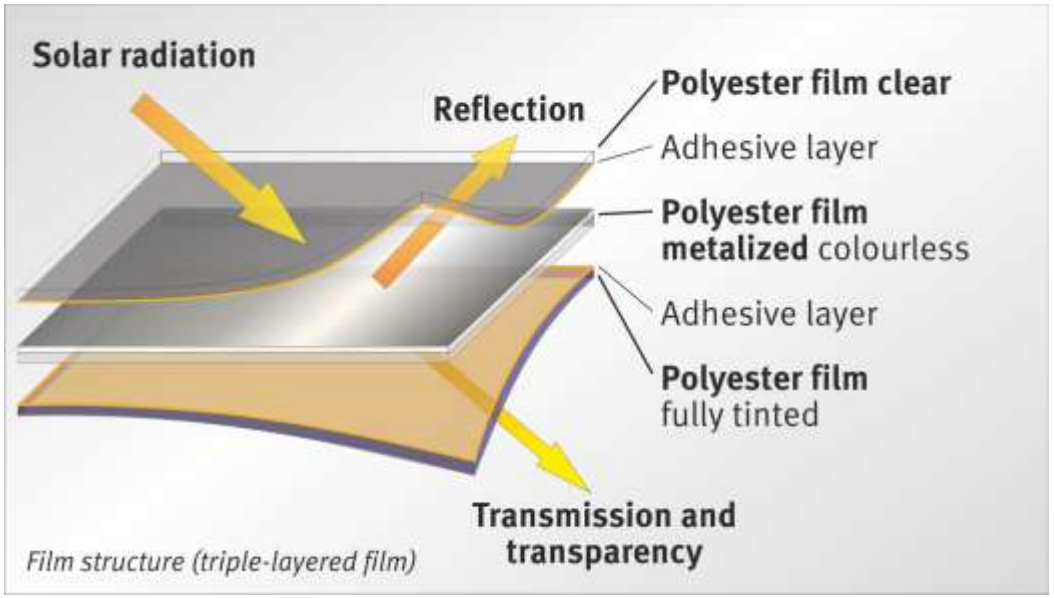
„Core piece“ of our products: the film



Transparent, highly reflective polyester film with triple effect:

- Optimal glare protection
- Excellent solar heat protection
- Good view to the outside

Features:

- Highly reflective thanks to an aluminium coating
- As thin as a hair
- Double or triple-layered
- Differ in colour, visible transmittance and solar reflectance
- Hardly inflammable, non-trickling and weakly smoky according to ÖNORM A 3800 Part 1

Description of MULTIFILM® shades

Si	At	02	2	S	N	M
Colour to outside	**Colour to room side**	**Visible light trans-mittance**	**Number of layers**	Extra strong layer	Nano-coated production prozess	Multifilm production according to special specifications

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Important technical terms I

Transmission

The ratio of the total solar radiation, which passes as visible light and infrared radiation a material system. Value is expressed in percent.

Visible transmittance

The ratio of the visible light, which passes a material system.

Absorption

The ratio of the total solar radiation absorbed by a material system whereby the energy of the material system is raised.

Reflection

The ratio of total solar radiation which is reflected from the surface of a material system.

g-value *= total solar energy transmittance*

The **value** g_{total} describes the quantity of sun energy which has been passed through the combination glass/blind and entered the room primarily and secondarily.

$g_{total} = g_{glazing/window}$ x F_c - value

Important technical terms II

U-value

The U-value indicates the **heat flow volume** in Watt that passes through a building element per square meter and Kelvin temperature difference between inner and outer temperature. **The lower the U-value, the better the insulation** of the building resp. the glazing system.

Measuring unit: W/m^2K

F_c-value *reduction ratio of shading systems (DIN 4108)*

The reduction coefficient F_c describes the **effectiveness of a shading system** against sun radiation. It is just a calculated value. The F_c-value characterises just one system consisting of glazing, window and sun protection.

F_c-value = g_{total} / $g_{glazing/window}$

Emissivity

Emissivity indicates how much radiation a body emits in comparison to an ideal heat radiator (black body).

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Solar spectrum

Ultraviolet radiation
100 280 315 380

Visible light
380 - 780

Infrared radiation
780 – 2.500

UV-C | UV-B | UV-A

Energy spreading	3 %	44 %	53 %

Wave length in nm (1 nm = 10^{-9} m = 0,000 000 001 m = 0,000 001 mm)

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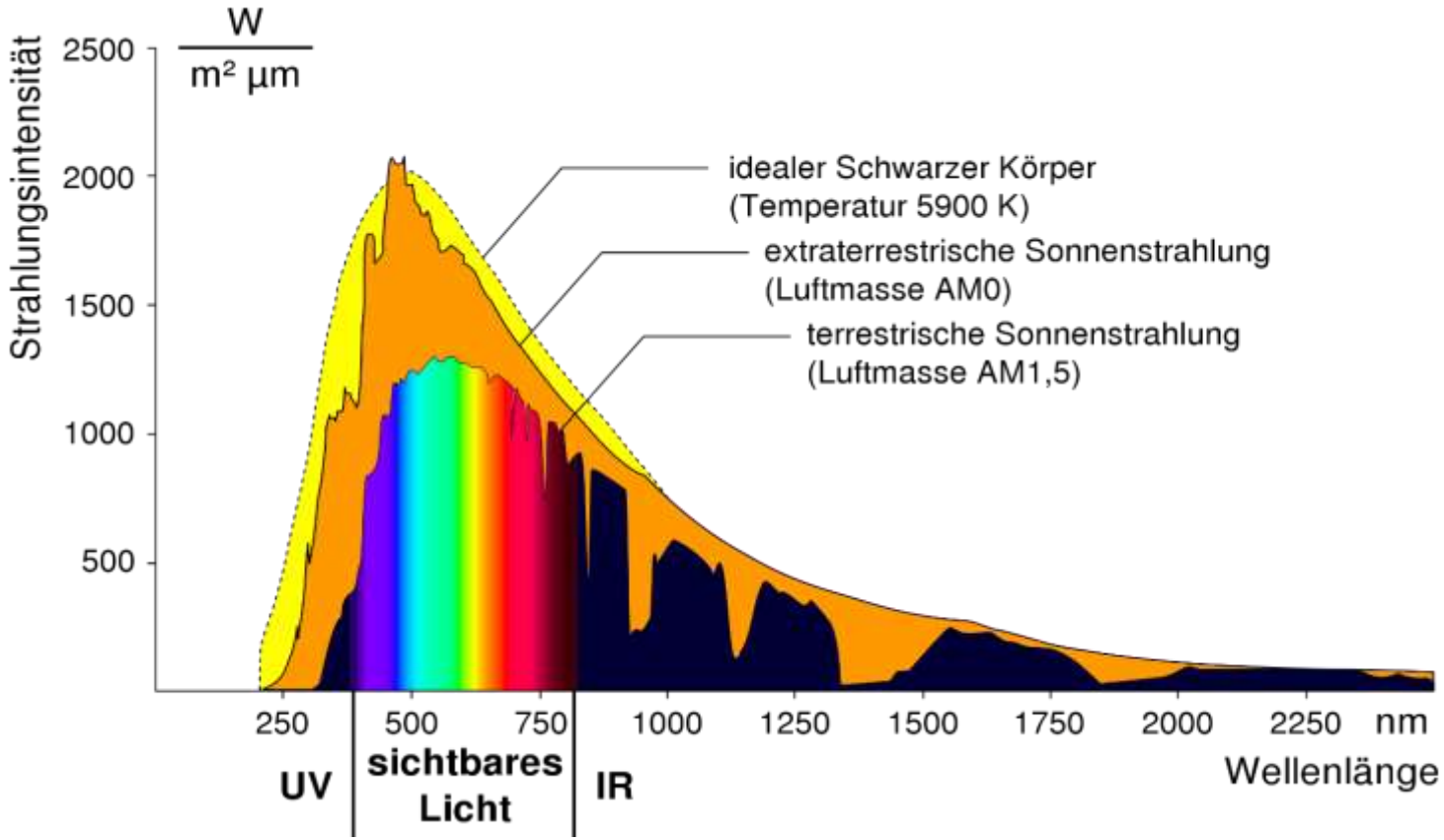
Difference between light and radiation

Definition of terms:

- Radiation → total solar dadiation (100 – 2.500 nm)
- Light → spectrum of visible light (380 – 780 nm)



https://upload.wikimedia.org/wikipedia/commons/0/08/Sonne_Strahlungsintensitaet.svg

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UV radiation

The UV transmission of the films corresponds approximately to the individual light transmission.
→ The films thus offer very good UV protection.

Radiation spectrum	Wave length	Properties
UV-C	100 – 280 nm	▪ Is absorbed by the atmosphere ▪ Does not reach the surface of the earth
UV-B	280 – 315 nm	▪ Cannot penetrate glass ▪ Causes body tanning ▪ Formation of vitamin D (prevention of rickets) ▪ Carcinogenic
UV-A	315 – 380 nm	▪ Can penetrate glass ▪ Causes skin aging, risk of melanoma

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Transmission, reflection, absorption and emissivity

Film SiAt01N			
Wave length 250 up to 2.500 nm (solar spectrum)	**Transmission**	**Reflection**	**Absorption**
Towards outside	1 %	83 %	16 %
Towards inside	1 %	45 %	54 %
Wave length 2.000 up to 25.000 nm (long wave infrared radiation)	**Transmission**	**Reflection**	**Emissivity**
Towards outside	-	31 %	69 %
Towards inside	-	19 %	81 %

g-value improvement / heat protection in summer

➔ the better, the higher the reflection of the solar radiation to the outside

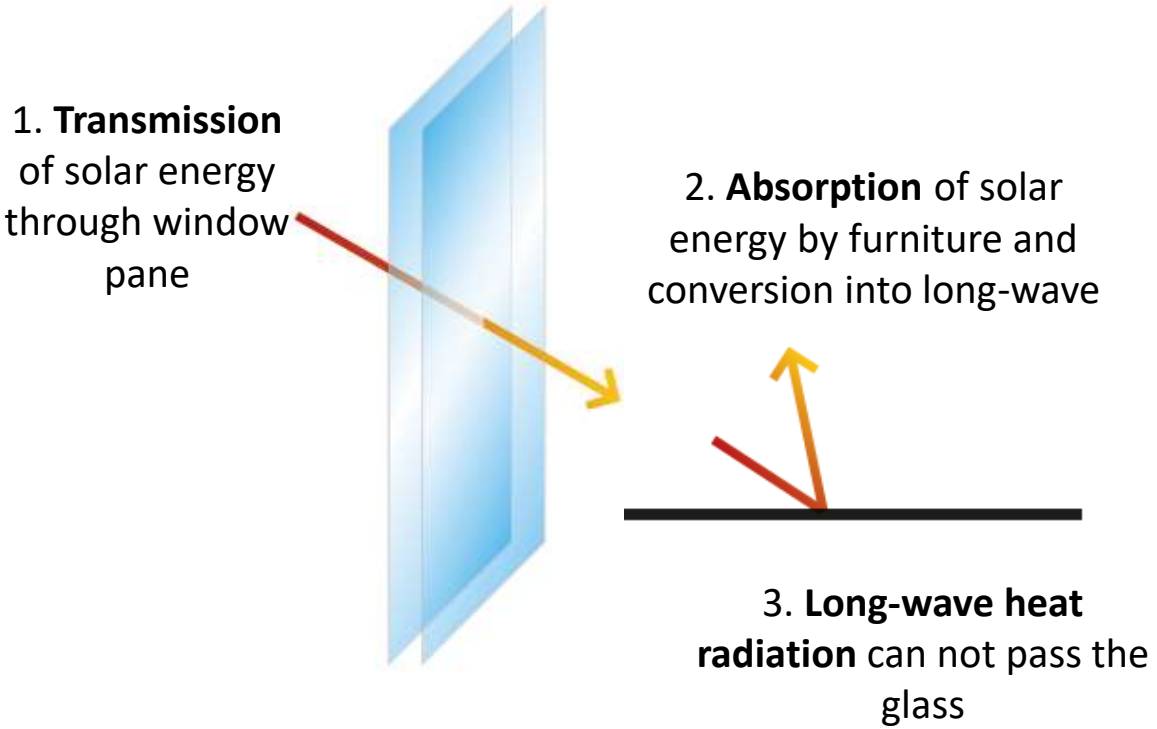
U-value improvement / thermal insulation in winter

➔ the better, the lower the emissivity to the outside

How interior film blinds work

Why a room heats up

Green-house effect



Result: **Increase of the room temperature by the green-house effect**

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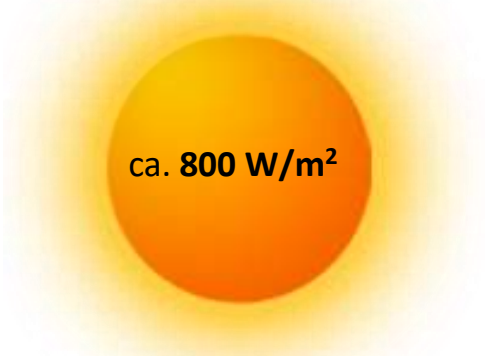
How interior film blinds work

Why a room heats up

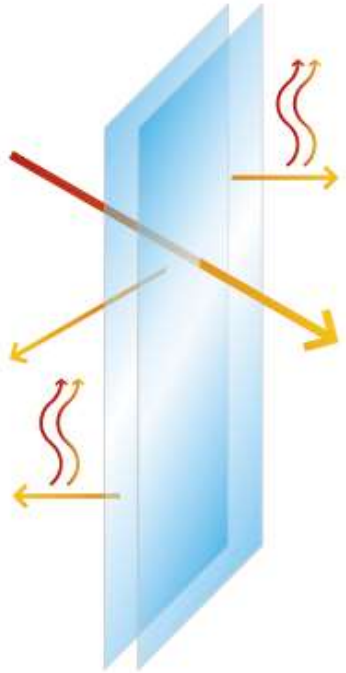
Radiation energy of the sun
(wave length 280 - 2.500 nm)



Solar energy, which hits the earth's surface corresponds approximately to the heating power of a hotplate (depending on geographic location and weather)

Radiation through
SunGuard® SuperNeutral double insulation glazing SN 70/37

100 % sun energy
(800 W/m²)



2 % heat emission through absorption on the window pane
(16 W/m²)

39 % reflecion
(312 W/m²)

35 % direct transmission of the sun energy
(280 W/m²)

24 % heat emission through absorption
(192 W/m²)

Result: **37 % of the solar energy (296 W/m²) reach the interior**

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Function of internal film roller blinds

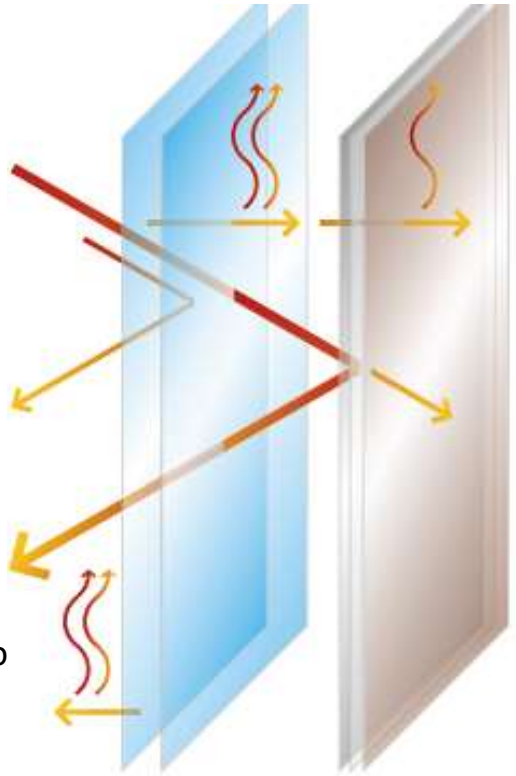
How to reduce the room heating by film roller blinds

SunGuard® SuperNeutral double insulation glazing SN 70/37 with film roller blind (film SiAt02)

100 % solar energy (800 W/m²)

58 % reflection of the solar energy on the window and aluminum coating of the film (464 W/m²)

32 % heat emission to the outside by absorption at the window pane (256 W/m²)



9 % heat emission to inside due to absorption on the window pane and the film (72 W/m²)

only 1 % direct transmission of solar energy (8 W/m²)

Result:

- only 10 % of solar energy (80 W/m²) remains in the room
- significant reduction of the room heating
- pleasant room climate

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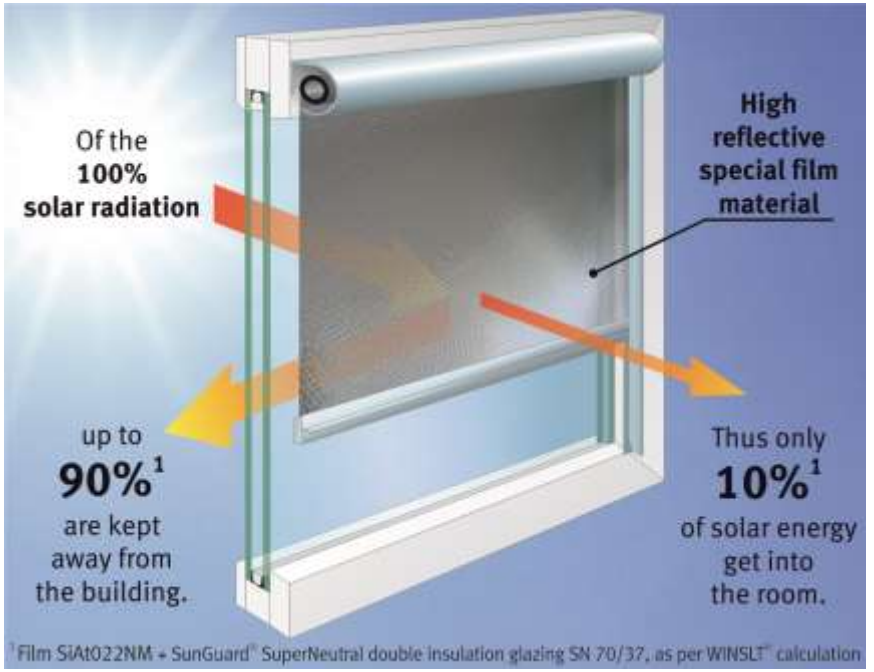
What does MULTIFILM® shade films offer?

Heat protection in summer/ g-value improvement

- Reflection of the solar radiation on the film's outside aluminium coating
- Thus only a little part of the sun energy gets into the room
- „Cold" radiation will be reflected before it can turn into heat inside the room
- This perceivably minimizes heat build-up inside the room, while the temperatures inside remain pleasant
- Significant savings of cooling energy



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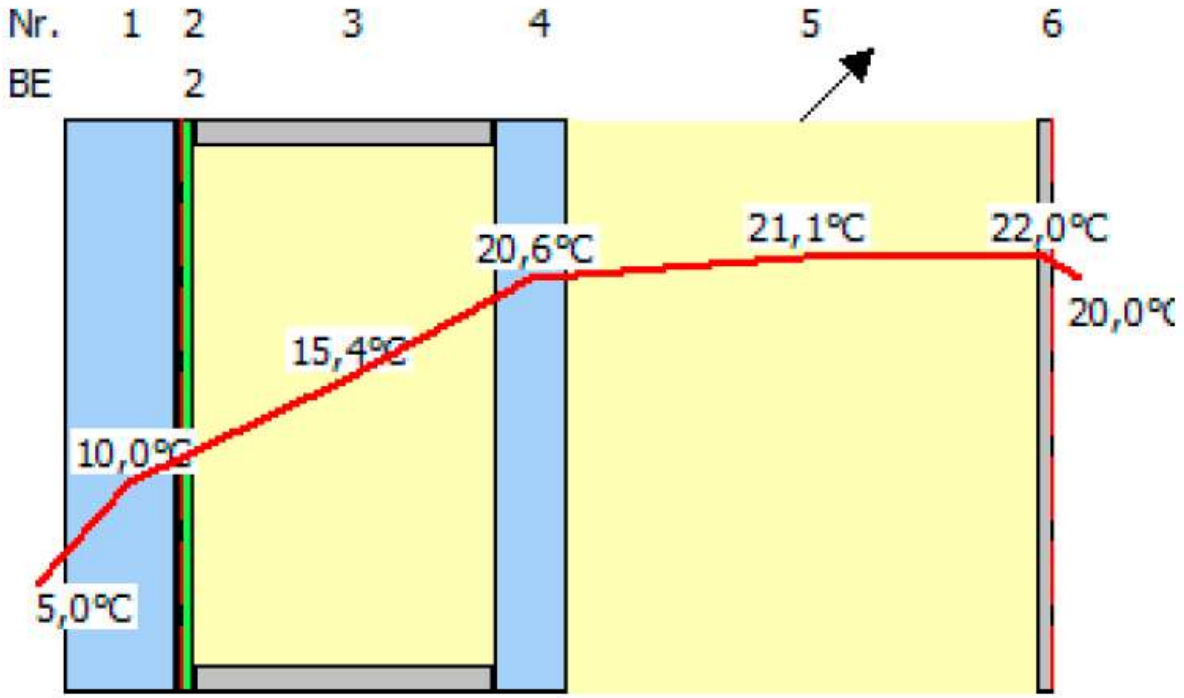
Temperature profile

SunGuard® SuperNeutral double insulation glazing SN 70/37 with film SiAt02



Nummer	BE	Bezeichnung	mm
1		Float ExtraClear	6,00
2	2	SG SN 70/37 (εn=1%)	
3		90% Argon	16,00
4		Float ExtraClear	4,00
5		Luft frei belüftet innen-innen A(in)=100,00% A(out)=25,00%	25,00
6		SiAt022NM 60 *)	0,15

Note:

- The radiation absorption at the window and film blind causes the glass to become somewhat warmer on a window with a film blind than on a window without shading.

- This effect does not lead to an additional heating, because the reduction of the energy input into the room by radiation transmission is much higher.

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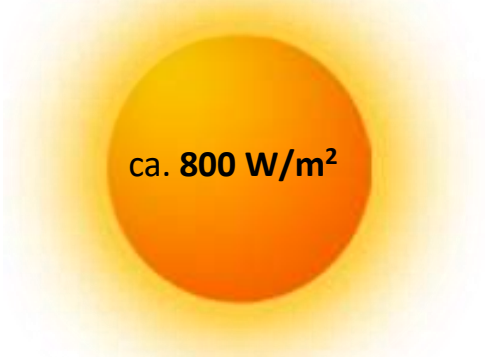
How interior film blinds work

Why a room heats up

Radiation energy of the sun
(wave length 280 - 2.500 nm)



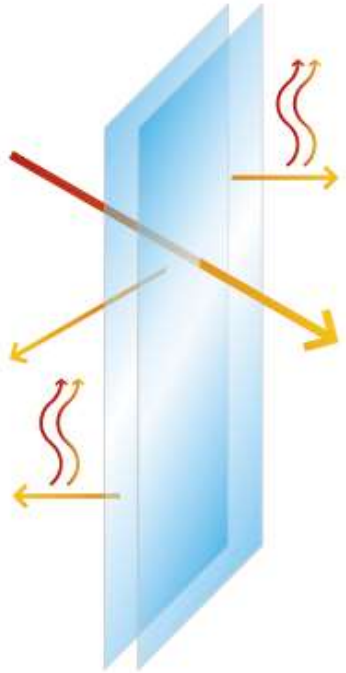
Solar energy, which hits the earth's surface corresponds approximately to the heating power of a hotplate (depending on geographic location and weather)

Radiation through ClimaGuard® double insulation glazing 1.0

100 % sun energy (800 W/m²)

39 % reflecion (312 W/m²)

8 % heat emission through absorption (64 W/m²)



6 % heat emission through absorption on the window pane (48 W/m²)

47 % direct transmission of the sun energy (376 W/m²)

Result: **53 % of the solar energy (424 W/m²) reach the interior**

MULTIFILM®

Function of internal film roller blinds

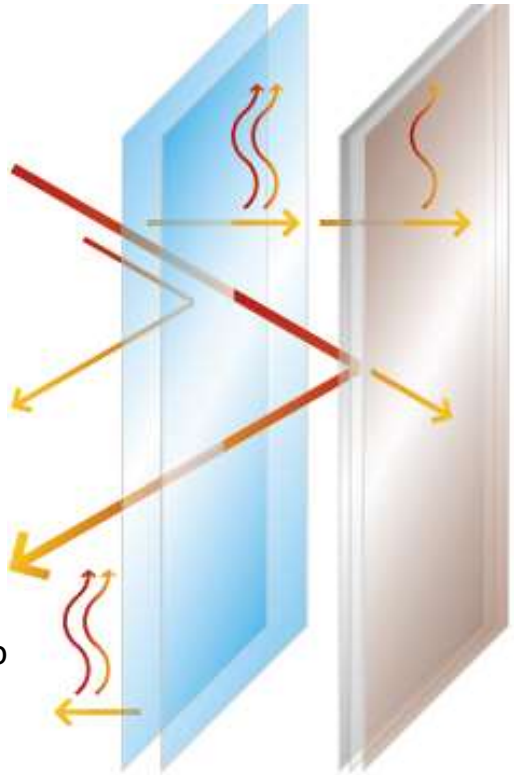
How to reduce the room heating by film roller blinds

ClimaGuard® double insulation glazing 1.0
with film roller blind (film SiAt02)

100 %
solar energy
(800 W/m²)

68 % reflection
of the solar energy
on the window and
aluminum coating of
the film (544 W/m²)

13 % heat emission to
the outside
by absorption at the
window pane
(104 W/m²)



18 % heat
emission to inside
due to absorption
on the window
pane and the film
(144 W/m²)

only 1 % direct
transmission of
solar energy
(8 W/m²)

Result:

- only 19 % of solar energy (152 W/m²) remains in the room
- significant reduction of the room heating
- pleasant room climate

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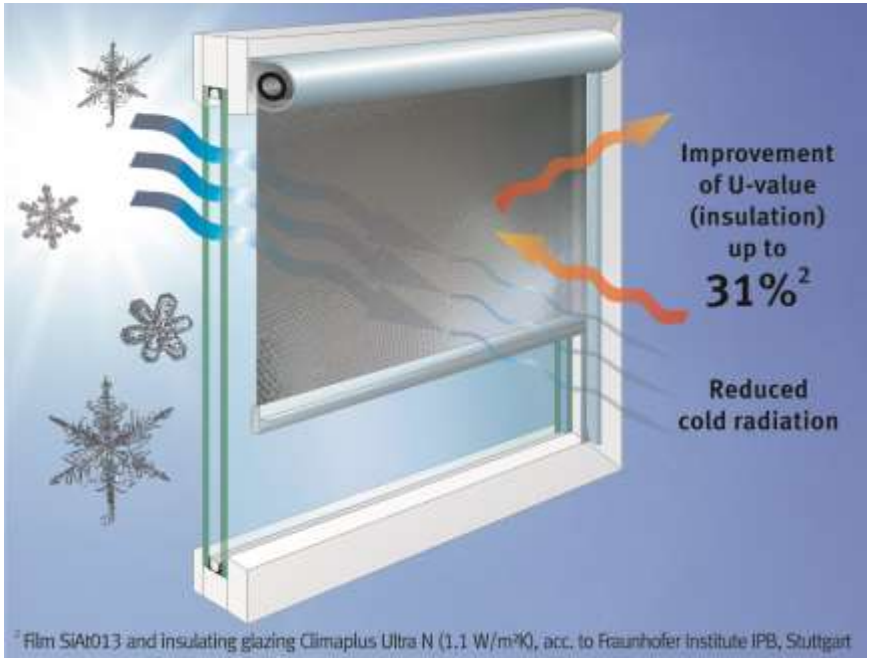
What does MULTIFILM® shade films offer?

Thermal insulation in winter/ U-value improvement

- Roller blind with side guides acts against the thermal loss through the window due to its insulating properties
- Reflection of the heat radiation back into the room
- Closed air cushion between roller blind and window
- Warmth is kept longer in the room
- Saving of heating energy
- U-value improvement of window and façade



Example:

Glass type	Structure	U-value glass	g-value glass	Film	U-value total	g-value total	F_c-value	Source
Climaplus Ultra N 1,1	Double thermal insulating glass 4/ 10Kr/ 4	1.10	0.50	SiAt01	**0.76**			Fraunhofer

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g- and U-value improvement by using film roller blinds

Glass			Film	Glass with film roller blind				
Type/ Structure	g-value	U-value	Type	Total g-value	g-value improvement	F_c-value	Total U-value	U-value improvement
Double layered **insulation glazing** (4/14Air/4) (existing glazing in old construction)	0.77	2.81	SiAt01	0.19	75 %	0.25	1.60	43 %
			SiAt02	0.24	69 %	0.31	1.63	42 %
Double layered **thermal insulation glazing** Climaplus Ultra 1.1 N (4/16Ar/4)	0.63[4]	1.10[4]	SiAt01	0.21	67 %	0.33	0.76[1]	31 %
			SiAt02	0.26	59 %	0.41	0.76	31 %
Double layered **thermal insulation glazing** Climaplus V 1.1 N (4/16Kr/4)	0.54[2]	1.10[4]	SiAt01	0.17[2]	69 %	0.32[2]	0.76	31 %
			SiAt02	0.25[2]	54 %	0.46[2]	0.76	31 %
			SiAt07	0.29[2]	46 %	0.54[2]	0.76	31 %
			SiWt00	0.18[2]	67 %	0.33[2]	0.76	31 %
Triple layered **sun protection glazing** Sunbelt Polaris 65/34 (6/16Kr/4)	0.38[2]	1.10[4]	SiAt01	0.12[2]	69 %	0.31[2]	0.84	24 %
			SiAt02	0.14[2]	63 %	0.37[2]	0.85	23 %
Triple layered **sun protection and thermal insulation glazing** (6/12Kr/4/12Kr/6)	0.43	0.51	SiAt01	0.26	40 %	0.60	0.44	14 %
			SiAt02	0.28	35 %	0.65	0.44	14 %
Triple layered **sun protection and thermal insulation glazing** Solawer Neutral STW 12 VSG (10/12Ar/6/12Ar/6)	0.27[4]	0.70[4]	SiAt01	0.17[3]	37 %	0.63	0.57	19 %
			SiAt02	0.18[3]	33 %	0.67	0.58	17 %
Triple layered **thermal insulation glazing** (4/16Ar/4/16Ar/4)	0.48	0.70	SiAt01	0.28	42 %	0.58	0.58	17 %
			SiAt02	0.30	37 %	0.63	0.59	16 %

[1] The Fraunhofer Institute for Building Physics Stuttgart; [2] Technical University Berlin; [3] Institute for Window Technology Rosenheim; [4] Manufacturer specifications; all other values: calculations

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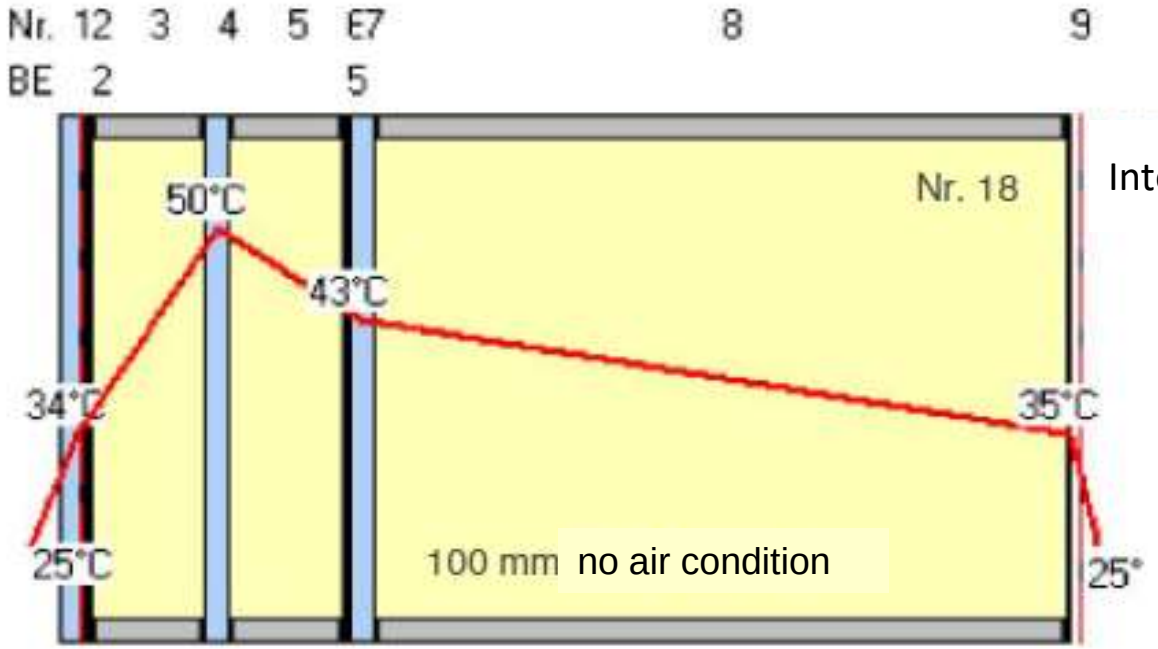
Film roller blinds on functional glazings

Temperature profile on a triple thermal insulation glazing



Interior sun protection

Typical reaction of a thermal insulation glazing.
If the middle glass pane is coated, it should be a tempered safety glass.

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Use of film roller blinds on double and triple glazing

- At double glazing the percental improvement of g- and U-value is higher than at triple glazing.
- The better the values of the glazing itself, the better are the values of glazing **with** sun protection systems.
- At thermal insulation glazing the improvement of g-value is higher than at sun protection glazing.
- There is no risk of glass breakage if the technical rules are applied.
- At triple glazing only highly reflective sun protection systems are allowed to use. (ρ>70 %)
- At triple glazing the middle pane must not have any coating or it has to be made of single-pane safety glass (ESG).
- **Please pay attention to the installation and security instructions in our *Technical Documentation*.**

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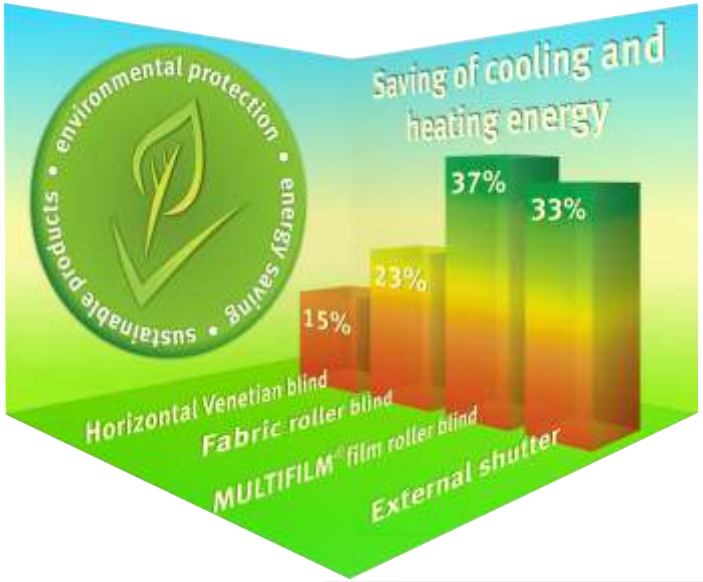
37% energy savings by using film roller blinds



Determining of the actually power savings for cooling and heating by using film roller blinds on the basis of a calculation model
(computations done with software application Parasol, V6.6, University Lund/Sweden)

Results:

- By using film roller blinds, **37 % energy savings on cooling and heating** can be achieved as against a nonshaded window.
- The film roller blind takes up the top position among comparable systems.
- The Fc-value of the studied film-glass combination is at 0.44. This corresponds to energy efficiency class 2 (“high”).
  (According to energy efficiency classification by association of internal sunscreen (ViS)

Sun protection system	Roller blind	Roller blind	Venetian blind	Venetian blind
Position	internal	internal	internal	external
Hangings	film SiAt01	fabric Verosafe 12.228/1	horizontal slats Turnils 17 Alumi-nium blank	aluminium slats
Remarks	side guides	without side guides	vertical blinds in cut-off position	vertical blinds in cut-off position
Total U-value	0,89	1,11	1,17	
Total g-value	0,26	0,41	0,51	
F_c-value	0,44	0,70	0,86	
Total cooling and heating energy requi-rement without sun protection in kWh	998	998	998	998
Total cooling and heating energy requi-rement with sun protection in kWh	625	775	845	670
Total cooling and heating energy savings with sun protection in %	37	23	15	33

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Properties and use of MULTIFILM® shade films

Film type	Properties	Application
SiAt01 **SiAt02** **SiBc02**	▪ **very good glare protection** (less visible transmittance of 1-3 %) ▪ **very good heat protection** (high solar reflection of approx. 78 %) ▪ **good view to the outside**	PC working place
GyGy02 **GyGy07** **GyGy033SR**	▪ reflections on the façade will be avoided ▪ film is hardly visible from outside ▪ GyGy022 and GyGy033SR: very good dazzle protection ▪ unhindered exterior view	historic buildings, museums, airport towers, ships
SiBk00 **SiWt00**	▪ to darken rooms ▪ no transparency ▪ **very good heat protection** (solar reflectance more than 80 %)	conference rooms, black-out in living and bedrooms

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Physical light and radiation properties and usage

Film	Remarks	Colour outside / inside	Visible transmittance T_{VL}	Solar reflectance	g-value	Suitability in respect of		
						Heat protection	Glare protection	View to outside
SiAt012N / SiAt013N		silver / anthracite	1 %	79 %	5 %	++	++	++
SiAt022/SiAt022NM SiAt023/SiAt023NM SiAt023SNM		silver / anthracite	2 %	74 %	7 %	++	++	++
SiAt072 / SiAt072N		silver / anthracite	7 %	61 %	17 %	+	+	++
SiBc022 / SiBc023		silver / bronze	2 %	75 %	8 %	++	++	++
SiBc092		silver / bronze	9 %	59 %	19 %	+	O	++
SiSi022		silver / silver	2 %	79 %	9 %	++	O	+
SiSi183		silver / silver	16%	67 %	18 %	+	O	++
GyGy022N		grey / grey	3 %	23 %	26 %	-	++	++
GyGy073		grey / grey	7 %	17 %	40 %	-	+	++
SiBk002	black-out film	silver / black	0,01 %	84 %	3 %	++	++	-
SiWt002	black-out film	silver / white	0,10 %	84 %	5 %	++	++	-

Further properties: - Excellent protection against UV rays.
- Hardly inflammable according to ÖNORM A 3800 Part 1, non-trickling and weakly smoking.

All technical specifications are subject to manufacturing related tolerances. **++** very suitable **+** suitable **o** partly suitable **-** not suitable

MULTIFILM®

Special films

Film	Explanation	Colour outside / inside	Visible transmittance T_{VL}*	Solar reflectance*	g-value*	Suitability in respect of		
						Heat protection	Glare protection	View to outside
SiAt1V2 MULTIFLEX®	with 2 sections of different visible transmittance	silver / anthracite	2 % / 6%	61 %	17 %	++	++	++
SiAt023SNM	extra strong triple-layered film for improved surface stability	silver / anthracite	2 %	74 %	7 %	++	++	++
GyGy033SR	Film with single-side scratch resistant surface	grey / grey	3 %	16 %	35%	-	++	++

Further properties: - Excellent protection against UV rays**.**
- Hardly inflammable according to ÖNORM A 3800 Part 1, non-trickling and weakly smoking.

All technical specifications are subject to manufacturing related tolerances. **++** very suitable **+** suitable **o** partly suitable **-** not suitable

MULTIFLEX® - SiAt1V2 for daylight-optimized room illumination

- Film with two or more sections with different light transmissions
- Film enables daylight-optimized room illumination and even more individuality in sun and glare protection, especially at workplaces
- Basic colour of the film, light transmission of the individual sections and their number and height are free of choice
- Standard: silver-anthracite-coloured film with 2 % and 6 % light transmittance
- 2 % part of the film at the top of the roller blind ensures optimal glare protection
- 6 % part of the film at the bottom of the roller blind is at eye level of the user and allows a better visual connection to the outside, without glare
- Solar reflectance 61 % (of the basic film material SiAt072)

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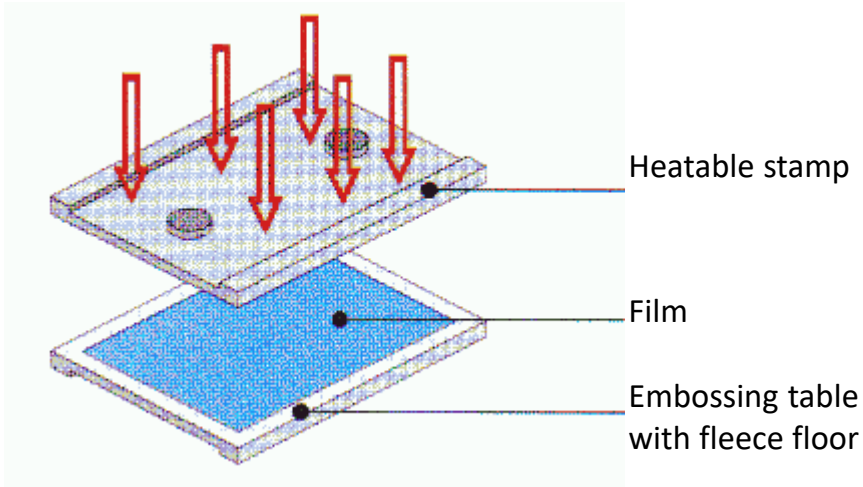
Range of MULTIFILM® shade films

Film	Order abbreviation	Number of layers	Max. width of film in m	Colour outside/ inside	Visibile transmittance T_{vl}	Solar reflectance	g-value	Suitable in respect of: Heat protection	Glare protection	View to the outside	Weight in g/m²	Comments
SiAt012N	73	2	1,83 (72")	silver/anthracite	1%	81%	5%	++	++	++	110	
SiAt013N	74	3	1,83 (72")	silver/anthracite	1%	81%	5%	++	++	++	145	
SiAt022	30	2	1,83 (72")	silver/anthracite	2%	74%	7%	++	++	++	110	
SiAt022NM	76	2	1,83 (72")	silver/anthracite	2%	78%	7%	++	++	++	110	
SiAt023	31	3	1,83 (72")	silver/anthracite	2%	74%	7%	++	++	++	145	
SiAt023NM	77	3	1,83 (72")	silver/anthracite	2%	78%	7%	++	++	++	145	
SiAt023SNM	78	3	1,83 (72")	silver/anthracite	2%	74%	7%	++	++	++	220	for FFS and C2
SiAt072 / SiAt072N	32 / 72	2	1,83/1,52	silver/anthracite	7%	61%	17%	+	+	++	110	
SiBc022	20	2	1,52 (60")	silver/bronce	2%	75%	8%	++	++	++	110	
SiBc023	21	3	1,83 (72")	silver/bronce	2%	75%	8%	++	++	++	145	
SiBc092	22	2	1,52 (60")	silver/bronce	9%	59%	19%	+	o	++	110	
SiSi022	10	2	1,52 (60")	silver/silver	2%	79%	9%	++	o	+	110	
SiSi182	11	2	1,52 (60")	silver/silver	16%	67%	18%	+	-	++	110	
SiSi183	12	3	1,52 (60")	silver/silver	16%	67%	18%	+	-	++	145	
GyGy022N	53	2	1,52 (60")	grey/grey	3%	23%	27%	-	++	++	110	not unembossed
GyGy033SR	52	3	1,83 (72")	grey/grey	3%	17%	37%	-	++	++	188	one-sided scratch protected surface
GyGy073	50	3	1,83 (72")	grey/grey	7%	17%	40%	-	+	++	145	
SiBk002	80	2	1,52 (60")	silver/black	0,01%	84%	3%	++	++	-	110	blackout film
SiWt002	81	2	1,52 (60")	silver/white	0,10%	84%	5%	++	++	-	110	blackout film
ClCl862	93	2	1,52 (60")	clear/clear	86%	12%	85%	-	-	++	110	not-tinted clear film
SiAt1V2 MULTIFLEX	36	2	1,52 (60")	silver/anthracite	2% / 6%	61%	17%	+	+/++	++	110	with 2 sections of different visible transmittance

Depending on the product size and product type MULTIFILM® reserves the right to use a double or a triple-layered film at films of same transmission and type.
All technical data are subject to manufacturing-specific tolerances.

MULTIFILM®

Film processing: Thermal flat-embossing



Technology

- Film will be embossed flat on the table and can cool down in that position
- During embossing the film will not be moved
- Discontinuously process
  → work and time expensive

Result

- High resistance against mechanical stresses, e.g. scratches
- Diffuse light scattering in the room
- Reduction of the reflection to the outside
- Preservation of the good transparency

MULTIFILM®

Film processing

Ultrasonic welding

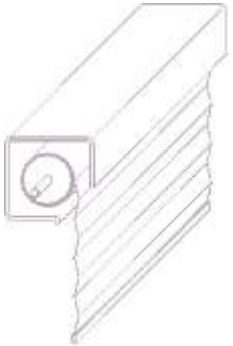
- Special joining method by ultrasonic welding for super-strong adhesion of individual film pieces up to a format of 3 x 8 m
- Enables shading of large surface glazing with just a single system
- Inconspicuous, fully resilient seam
- Welding position at neighbouring blinds at the same height

MULTIWAVE® pleated blind

- **patented process** for film stabilization
- **harmonious interior and exterior view**
- **one-sided pleating**; gentle and arched
- Pleated division 30, 60, 80 or 100 mm
- Pleated blinds up to 3 m wide for large-format systems

... compared to the zig-zag pleated blinds

- Possible pleated division: 10 to 30 mm
- Same division per master roll
  → no small quantities with different division
- Only for calender embossed films



MULTIFILM®

MultiDecor® colour printed films

- Full-surface coloring of polyester film by means of sublimation printing
- Storage of the transparent colour pigments in the polyester
  → **Transparency/ view to the outside** remains
  → With internal printing, high radiation reflection/
  heat protection remains unaffected
  → 100% **abrasion-resistant**
  → Highly **lightfast** (at least class 5-6, usually 6 to> 7,
  according to DIN EN ISO 105-B02)
  → The surface of the printed film is embossed and can be pleated and welded
- Delivery time 3 weeks (from any necessary approval)

Base films for MultiDecor® and print image

- transparent colours (similar stained glass or ink) require a light background (overlay / mixture with fiml colour of anthracite or bronze films)

  → with printing on the room side SiSi022, SiSi183 (metallic effect) or SiWt002 films

  → Printing on the outside on any silver film possible

- White cannot be printed, white image areas remain without colour

  → the film's own colour appears

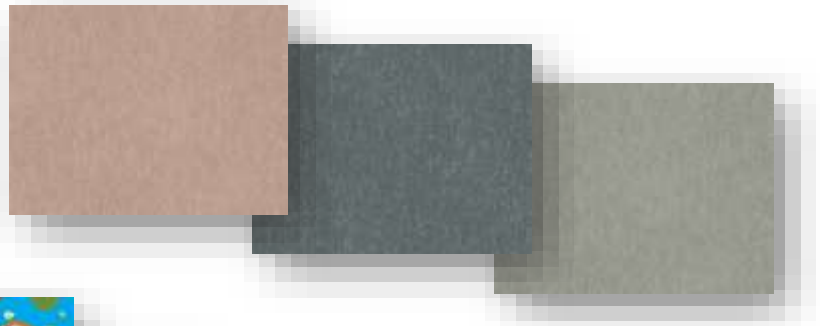
- very good print result with rich colours

MULTIFILM®

MultiDecor® assortement (analogue MultiDecor®-Booklet)

1. Standard range

- 12 standard decors on stock
- Max. width : 1,540 mm (not turnable decors)
  2,800 mm (turnable decors)



2. Special range

- 20 decors in 3 to 5 colour shades each;
  further colour shades on customer request
- Max. width: 2,800 mm

Kinder HAUS

3. Individual decors

- Designs, photos, logos, collages
  according to customer requirements
- Print file according to template (eps, cdr, jpg, tif, pdf)

Londell
colour your hair style

4. Plain colours

- Full-surface colours according to the colour sample card
- Further colours on customer request after sampling