

Carpet Solutions: Polyamide

Dyeing and printing of carpets requires specific solutions



Make your carpet colorful!

Carpet Solutions: Polyamide

Fibers for carpets

Substrates

Carpets are made of different fibers and fiber blends. Polyamide fibers are most common, but wool, polyester and polypropylene fibers are also used.

Polyamide fibers

Polyamide is produced from petrochemical feedstocks. Two types - polyamide 6 and polyamide 6.6 - are generally produced today. Due to their properties and wide-ranging coloration options, they can be used to produce hard-wearing carpets. Dye penetration is facilitated by the fact that polyamide has better water absorption than other types of manmade fibers.

Physical properties such as handle, durability, soil repellency and especially the appearance of the carpet can be modified by the type of yarn, its fineness and luster.

Polyamide 6.6 fibers are obtained by condensation of hexamethylene diamine and adipic acid followed by polymerization.

Polyamide 6 is produced by a different procedure, comprising the addition of caprolactam and aminocapron acid followed by polymerization.

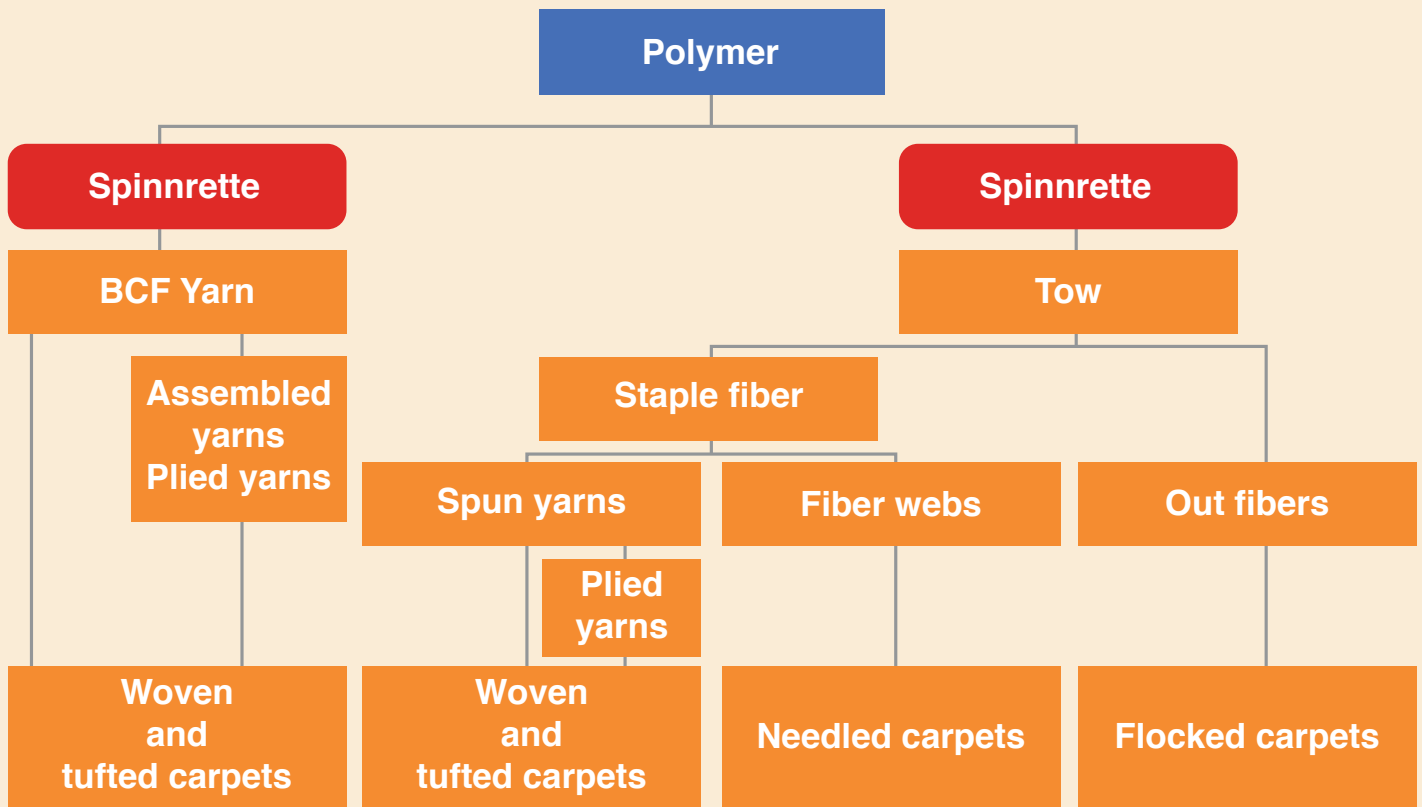
In both cases, polycondensation or polymerization produces a hot spinnable mass (dope). This can be cooled and processed into granules or spun directly to produce a filament.

During spinning, the filaments are drawn and cooled to room temperature with air or water. The molecules are not oriented when they leave the spinneret. The yarn is then drawn to many times its initial length to give it its textile properties and final structure. Drawing also increases its resistance. Consequently, uneven spinning and drawing results in unlevel dye uptake and thus to streaky carpets. The final structure of the filament is produced by a combination of crimping and heat setting. This gives it its volume, bulk and resilience.



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Polyamide fibers



Bulked continuous filaments (BCF yarns)

BCF yarns consist of between a dozen and three hundred filaments which can be spun to a length of several kilometers.

Staple fibers

Staple fibers are produced from the same polymer as BCF yarns (see above). The essential difference is spinning produces a tow which is then cut into short fibers. These fibers can be processed into yarn by traditional spinning methods.

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Polyamide fibers

Yarn structure/fiber cross-section

Filaments can be spun with different cross-sections. This influences the appearance and physical properties of the carpets produced from them. The most frequently used cross-sections are round, followed by trilobal and square.



- 1 Round cross-section
- 2 Square cross-section
- 3 Triangular cross-section
- 4 Triangular cross-section with profile
- 5 Cross-section with channels

The structure of the yarn has a major influence on the appearance of the carpet and its properties (handle, luster, resilience and soiling).

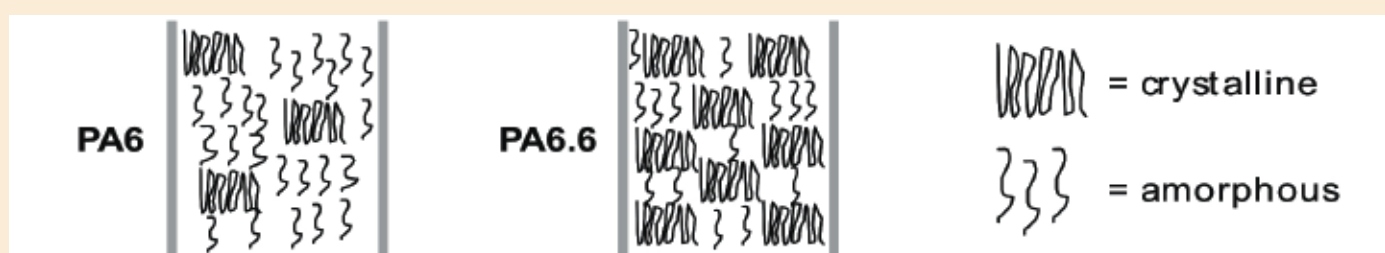
Fiber morphology

The term "morphology" is used to describe the accessibility of the amino end-groups to the dyes. This depends partly on the spinning process and partly on the heat-setting of the fiber. The fiber morphology is thus influenced by thermal processes.

The number of amorphous sections in the fiber is lower, if it is heat set using dry heat.

Heat-setting with superheated steam increases the number of amorphous end-groups and thus the dye-ability of the fiber.

Increasing the dye absorption of the fiber also affects the wet fastness and light fastness of the dyeing.



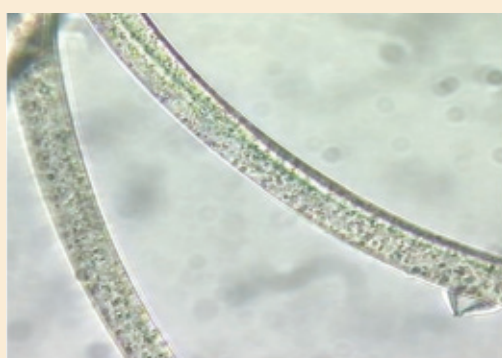
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Polyamide fibers

Delustering

Since polyamide is by nature bright, a delustering agent is added to the polymer to make the textile look more natural. Titanium dioxide is normally used for matting.

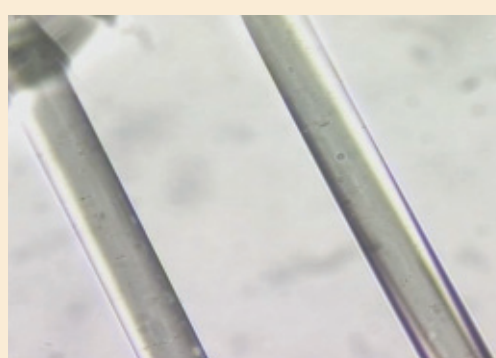
dull



1,0% Telon® Red M-GWN

2,5% Isolan® Black 2S-LD

bright



1,0% Telon Red M-GWN

2,5% Isolan Black 2S-LD

Note: If the fiber is heavily delustered, the light fastness of the dyeing is lower than if less delustering agent is applied. This is because dull fibers absorb more energy from light. This reduces the light fastness of the dyeings by 1-1.5 grades.

Dyeability

Dissociation of the carboxyl and amino end-groups varies with the pH. The lower the pH of the liquor, the more amino end-groups are protonized. Anionic dyes mainly color these groups, so dyeing can be controlled via the pH of the dye liquor.

Determination of fiber data

To ensure that optimum dyeing and printing processes are used and meet fastness requirements, it is important to know the chemical and physical properties of the polyamide fiber.

Our carpet center can perform the following tests to determine the necessary fiber data:



- Determination of the S_f value which indicates the number of the amino end-groups and gives an indication of dye absorption
- Determination of the V value, which shows the strike rate required to achieve the shortest dyeing time and most level dyeings.

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Dye Selection for Polyamide Carpet

Dye selection should be based on the following criteria:

- Levelness (combinability)
- Build-up (exhaust behavior; solid shades)
- Fastness properties
- Fixation (dyeing and printing)
- Energy required to fix dyes
- Brilliancy
- Substrate (fiber quality)
- Ecological aspects
- Price

++	Disperse dyestuffs	Dianix®	--
 Covering of Bairiness	Acid levelling dyestuffs (monosulphonated)	Telon®	 Wet fastness
	Acid half milling dyestuffs (monosulphonated)	Telon A	
	Acid milling dyestuffs (disulphonated)	Telon M	
	Pre-metallised dyes (non sulphonated)	Isolan®	
	Mix out of pre-metallised dyes	Isolan NHF-S	
	Pre-metallised dyes (monosulphonated)	Isolan S	
	Pre-metallised dyes (disulphonated)	Isolan 2S	
	Reactive dyes	selected Levafix®/Remazol®/Realan®	

Carpet Solutions: Polyamide

Telon®

Polyamide dyes with good leveling properties, for pale to medium shades

- Mono sulphonated levelling acid dyes
- Very small molecules
- Good combinability
- Very good levelling and migration properties
- Very good covering of barriness
- No blocking effects
- High light fastness level



Telon Yellow RLN micro ✓

Telon Yellow FRL micro ✓

Telon Yellow 4R micro ✓

Telon Brown 3G 200%

Telon Red BRL micro * ✓

Telon Red 2BL micro ✓

Telon Red 2BN

Telon Red FRL micro ✓

Telon Pink BRLF ✓

Telon Blue GGL

Telon Blue BRL micro ✓

Telon Yellow T-3R

Telon Red T-2B

Telon Blue T-4R

* Only for continuous processes

✓ Salt free

Carpet Solutions: Polyamide

Telon® A

The economical polyamide range for medium shades

- Mono sulfonated half milling acid dyes
- Good combinability
- Good levelling and migration properties
- No blocking effects
- Good covering of barriness
- Better wet fastness than Telon dyes

Trichromatic recommendation

Telon Yellow A3GL

Telon Yellow ARB

Telon Yellow A3R

Telon Red A2FR

Telon Red AFG

Telon Rubine A5B

Telon Blue AGLF

Telon Blue AFN

Telon Blue A3GL

Telon Navy AMF

Telon Black AMF

Telon Yellow A2R

Telon Red A2R

Telon Blue A2R

Carpet Solutions: Polyamide

Telon® M

Polyamide dyes with good leveling properties

- For brilliant shades
- Disulfonated milling acid dyes
- High wet fastness
- Combinable with Isolan® NHF-S-/2S dyes
- In order to avoid blocking, no standard ternary combination is recommended. However, a main dye with shading components can be used. Isolan NHF-S/2S dyes can also be used for shading.

Telon Yellow M-4GL ✗

Telon Red M-CP ✓

Telon Red M-BL

Telon Flavine M-7G +

Telon Rhodamine M-BN +

Telon Blue M-GLW ✓

Telon Blue M-BLW ✓

Telon Blue M-RLW

Telon Blue M-2R

Telon Violet M-RWN

Telon Green M-6GW ✗ ✓

Telon Green M-BW ✓



**Combinable range with
Isolan NHF-S
and 2S dyes**

+ Critical light fastness

✗ Telon Green M-6GW can not combined with
Telon Yellow M-4GL concerning catalytic fading

✓ Salt free

Carpet Solutions: Polyamide

Isolan®

The polyamide dye range with highest light fastness

Isolan dyes are 1:2 metal-complex dye with no sulfo groups. They are suitable for dyeing dull, pale to medium shades with very good wet fastness and very high light fastness containing selected range of dyes especially for automotive.

- 1:2 metal complex dyes without sulfo-groups
- High wet fastness levels
- Good to moderate covering of barness
- Very high light fastness level
- Especially recommended for automotive articles
- In printing, combinable with Isolan NHF-S dyes

 Isolan Yellow GRL ✦

Isolan Yellow K-GLN 250%

 Isolan Yellow K-PRL 200% ✓ ✦

Isolan Yellow NW¹⁾ ✓

 Isolan Bordeaux R 220% ✓ ✦

Isolan Orange K-RLS 135%

 Isolan Blue 3GL

Isolan Scarlet K-GLS 150% ✓ ✦

 Isolan Grey K-PBL 200% ✓ ✦

Isolan Black 3RL

 Isolan Silver NHF-S ✓ ✦


 Isolan Olive 2S-BGL ✓

¹⁾ Recommended for Chromojet dpi 76

✓ Salt free

✦ Standard combination (not suitable for automotive textiles)

✦ Standard combination for automotive textiles

 Dyes for automotive

Carpet Solutions: Polyamide

Isolan® NHF-S

The all-round dye range for polyamide

1:2 metal-complex dyes (with/without sulfo groups) with high wet fastness and excellent properties in ternary combinations.

- Excellent properties in ternary combinations
- High wet fastness
- High level of light fastness
- Combinable with Telon® M dyes (for brilliant shades) and Isolan 2S dyes (extremely high fastness requirements)
- In printing combinable with Isolan dyes
- Variety of shades can be maximized by combination with Isolan S and Telon M dyes
- Moderate coverage of barriness

Standard combination

Isolan Yellow NHF-S

Isolan Red NHF-S ✓

Isolan Blue NHF-S

Isolan Grey NHF-S

Additional dyes

Isolan Orange NHF-S ✗

Isolan Bordeaux NHF-S

Isolan Brown NHF-S

Isolan Red Brown NHF-S ✓

Isolan Navy NHF-S ✓

Isolan Ultramarine NHF-S

Isolan Silver NHF-S ✓

Isolan Black NHF-S

Additional dyes for 100% PA (correction of metamerism)

Isolan Red S-RL ✗

Isolan Olive S-G

✓ Salt free

✗ Isolan Red S-RL, Orange NHF-S can not be combined with Telon Yellow M-4GL concerning catalytic fading

Carpet Solutions: Polyamide

Isolan® 2S

Polyamide dyes for very high fastness

1:2 metal-complex dyes with two sulfo groups. These dyes are especially suitable for dyeing very deep, dull shades with very high wet fastness.

- **Very high wet fastness**
- **Combinable with Telon® M and Isolan® NHF-S dyes**
- **A true ternary combination is not recommended**
- **Blocking can occur**

To prevent blocking standard ternary combinations are not recommended. However, a main dye and shading components may be used. Telon® M and Isolan NHF-S dyes can also be used as shading components.

Isolan Yellow 2S-GLN

Isolan Scarlet 2S-L

Isolan Red 2S-BR

Isolan Bordeaux 2S-B

Isolan Olive 2S-BGL

Isolan Brown 2S-BL

Isolan Dark Blue 2S-GL ✓

Isolan Black 2S-LD

Isolan Black 2S-LGN liq

Isolan Black 2S-CP ✓

**Combinable range with
Isolan NHF-S
and Telon M**

✓ Salt free

Carpet Solutions: Polyamide

Supralan®

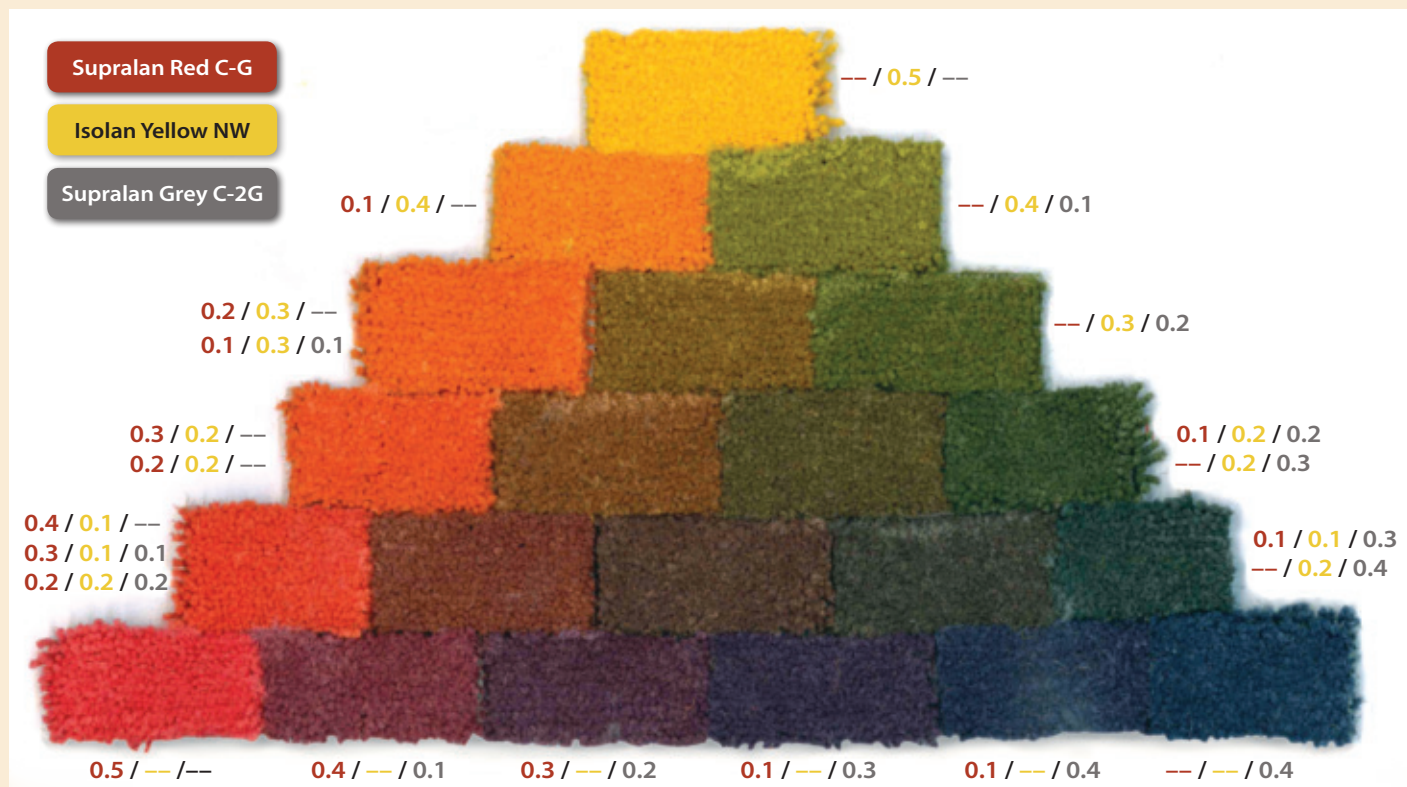
Supralan® range comprises 1:2 metal complex and acid (milling) dyes and covers virtually the whole color spectrum. Good choice as standard dye system against classic competition dye systems in the market.

➔ Additional Supralan dyes

- Isolan® Yellow NW ¹⁾ ✓
- Supralan Yellow C-2R ²⁾
- Supralan Red C-G
- Supralan Grey C-2G

- Supralan Yellow C-WN
- Supralan Red C-WN
- Supralan Grey C-WN
- Supralan Dark Blue C-WN
- Supralan Black S-B
- Supralan Green S-GLN

Basket of shades



¹⁾ Recommended for Chromojet dpi 76

²⁾ Not recommended for Chromojet dpi 76

✓ Salt free

Carpet Solutions: Polyamide

Telon[®] CD

Acid-dyes for better contrast in differential dyeing. Selected light fast disulfonated acid dyes, which have good migration properties in spite of their bi-functional character. It may be necessary to use a lower (more acid) pH when dyeing deep shades with these dyes.

- Disulfonated acid dyes
- Good contrast on deep dye and low dye fiber types
- Good combinability
- High light fastness

Telon Yellow CD-RG

Telon Red CD-RB

Telon Blue CD-RP

Astrazon[®]

A unique line of cationic dyeable polyamide dyes for the contrast and differential dyeing sector. Selected basic dyes for differential dyeing of anionic modified polyamide fiber.

- High wet fastness
- Good combinability
- High light fastness

Astrazon Yellow 8 GSL 200%

Astrazon Red BBL micro 200%

Astrazon Red YCN

Astrazon Blue 5GL micro 200%

Astrazon Blue NCN liq

Astrazon Blue 3RL micro 200%

Carpet Solutions: Polyamide

Realan[®], Levafix[®], Remazol[®] and Procion[®]

The Reactive dyes below with mono- and bi- functional anchor systems are selected to achieve:

- Light fastness minimum 4
- Wash fastness up to 95°C, even multiple washing
- Wet fastness is much higher than Telon M and Isolan 2S
- Best possible build up

Combinability and Catalytic Fading issues have to be checked on individual material.

For dark shades, a Polyamide quality with high amount of end-amino groups (> 70mg equiv./kg) is imperative.

Core Dye Selection

Remazol Luminous Yellow FL

Levafix Brilliant Yellow CA

Levafix Yellow CA

Levafix Amber CA-N

Levafix Scarlet E-2GA

Levafix Fast Red CA

Levafix Brilliant Red E-4BA

Levafix Rubine CA

Remazol Brilliant Blue BB

Levafix Blue CA

Realan Royal EHF

Procion Dark Blue H-EXL

Remazol Black RL

Additional Dye Selection

Remazol Brilliant Yellow 3GL

Procion Yellow H-E6G

Remazol Yellow 3RS

Remazol Yellow RNL

Procion Yellow H-EXL

Procion Brilliant Orange H-EXL

Remazol Brilliant Red 3BS

Committed to Sustainability

At DyStar, our products and services help customers worldwide reduce costs, shorten lead times and meet stringent quality and ecological specifications.



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