DIGITAL SPRAY PRINTING

Selected BEMACID | BEMAPLEX dyes
for digital spray printing on polyamide and wool
In the past carpets often served as a practical means of insulation in cold weather. Only the rich were in a position to use expensive, hand-woven carpets for decoration. It was not until manufacturing became cheaper and living standards improved on a general scale that carpets were used to create a cozy and comfortable atmosphere in the home. For this reason carpets will remain popular floor coverings alongside parquet flooring and other non-textile floor coverings in the future.

Modern carpets are generally made of PA, WO, PES or PP with very different percentage ratios. Around 50% of all textile floor coverings are made of polypropylene. It is easy to see why – polypropylene is very cheap to make and now also has an attractive look and feel. Accounting for around 40% of all textile floor coverings, polyamide fibres have a considerable market share on the one hand and on the other are very versatile with regard to look, feel and finishing options (dyeing, printing etc.).

Around 30% of all polyamide produced is used for carpet production. The rest is used for industrial applications and clothing at around 30% each.

Polyamide carpets are very popular among producers and consumers alike. Easy care, high dirt retention capacity, high inherent stability and excellent resistance to mechanical stress are only some of the advantages of polyamide fibres in everyday applications.

Colouring of carpets is as varied as it is sophisticated. Continuous processes are clearly superior to discontinuous processes with regard to the production capacity and patterning options. In the continuous sector one process has evolved particularly strongly in recent years: digital spray printing.

> DIGITAL SPRAY PRINTING

With this application method the carpet is «dyed» by a type of spraying method in accordance with the «drop on demand» principle, and in addition to the option of creating a wide range of varied and creative motifs, it has the following advantages:

- Fast switchover of patterns and templates
- No repeat borders
- Extremely sharp contours on fine details
- Ideal for short yardages
- Very suitable for «just in time» production
- No costs for making and cleaning screens
- Modified PA and PES qualities as well as 100% PES, PAN or WO can be printed
NATURE AS A SOURCE OF INSPIRATION

> **BEMACID | Bemaplex**

The BEMACID and Bemaplex range from CHT | BEZEMA features a versatile selection of system solutions with a wide range of dyes for polyamide and wool fibres. The comprehensive choice of dyes enables the selection of ternaries that optimally meet the respective needs and therefore enable economical processes and maximum product quality.

With the technically optimised dyes from the BEMACID | Bemaplex ranges, application on the highest level is now also possible for digital spray printing.

> **BEMACID DYES**

The BEMACID dyes are categorised in three groups, E, N or F, depending on their dyeing and fastness properties. The elements of group E have a very high light fastness, good migration properties, good coverage of kinetic barriness, good combinability, fast exhaustion even at low temperatures and fast fixing in saturated steam. Due to these properties BEMACID E dyes are often used for discontinuous dyeing of PA and WO carpets.

The N group combines acid dyes with a high neutral exhaustion capacity, good combinability, high build-up capacity, good wet fastness, good coverage of kinetic barriness and fast fixing in saturated steam. The elements of the F group have high fastness properties, a high degree of brilliance and are especially suitable for dyeing deep, bright shades. Their good solubility and high brilliance make them ideal printing dyes for classic printing techniques such as rotation or screen printing.

> **Bemaplex Dyes**

The Bemaplex dyes are divided into the following groups according to their sulphonyl group number: group N (without sulphonyl groups), M (with one sulphonyl group) and D (with two sulphonyl groups). When the sulphonyl group number increases, the solubility and wet fastness of a dye molecule normally increases, the build-up capacity decreases, the pH-dependence of the bath exhaustion and the effect of anionic auxiliaries increase.

<table>
<thead>
<tr>
<th>Dyestuff type</th>
<th>Trade name</th>
<th>Molecule size</th>
<th>Degree of sulphonation</th>
<th>Charge</th>
<th>Wet fastness properties</th>
<th>Migration properties</th>
<th>Coverage of barriness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid</td>
<td>BEMACID E</td>
<td>Small</td>
<td>mono-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>Acid</td>
<td>BEMACID N</td>
<td>Medium</td>
<td>mono-</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Acid</td>
<td>BEMACID F</td>
<td>Large</td>
<td>di-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1:2 Metal complex</td>
<td>Bemaplex N</td>
<td>Large</td>
<td>none / masked</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1:2 Metal complex</td>
<td>Bemaplex M</td>
<td>Large</td>
<td>mono-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1:2 Metal complex</td>
<td>Bemaplex D</td>
<td>Large</td>
<td>di-</td>
<td>-</td>
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</table>
The prerequisites for use in the carpet sector are the highest light fastness properties and fast, complete and even fixing under saturated steam conditions. Selected BEMACID and BEMAPLEX dyes meet these criteria.

Dyes used for application with digital spray printing methods have to meet special extra demands. The electrolyte content of the dyes is known to have a considerable influence on the viscosity of the printing paste. The viscosity in turn has a direct influence on the pick-up, penetration and therefore the colour depth and contour sharpness. Optimum printing results are achieved with the high purity level of the selected BEMACID | BEMAPLEX dyes at a reasonable cost.

Reliable use on digital spray printing systems is now guaranteed with selected and technically improved BEMACID | BEMAPLEX dyes. The above-mentioned properties of the following dyes from the BEMACID | BEMAPLEX ranges have been optimised and are recommended for modern spray painting:

- BEMACID Yellow E-4G
- BEMACID Yellow E-TL
- BEMACID Red E-TL
- BEMACID Blue E-TL
- BEMAPLEX Yellow M-T
- BEMAPLEX Red M-T
- BEMAPLEX Navy M-T
- BEMAPLEX Black D-TR

These selected BEMACID | BEMAPLEX dyes that have been optimised for digital spray printing have the following outstanding features:

- Excellent light fastness without a shift in colour after light exposure
- Low electrolyte content
- Excellent reproducibility
- Perfect combinability of all elements per group
- Fast, complete and even fixing of the ternary elements under saturated steam conditions
- Moderate to very good coverage of material-related barness
- Very economical
- Wide range of shades
- High flexibility

The majority of shades and colour depths can be achieved with this dye selection. Users are offered an adapted selection with which high production requirements with very high fastness requirements can be mastered with success. If necessary other dyes from the BEMACID | BEMAPLEX range are naturally also available as supplementary elements.
BEMACID – FOR MULTI-FACETED RESULTS

> BEMACID E-TL TERNARY

BEMACID Yellow E-TL, BEMACID Red E-TL and BEMACID Blue E-TL are the small molecular, very effectively levelling ternary elements with tone-in-tone build-up, excellent light fastness and maximum process reliability. BEMACID Yellow E-4G is the right choice as a shading element for bright colours. The dyes of the BEMACID E group have a high migration capacity and good coverage of material-related affinity differences.

The ternary is very suitable for printing carpets with digital spray printing processes due to the low electrolyte content and an optimised formulation; fast fixing is guaranteed, also in saturated steam. The light fastness properties meet the high demands of the carpet industry.

The wet fastness level is typical for this dye class. The ternary and shading components have an excellent combinability and do not undergo a shift in colour after light exposure.

The figures correspond to a colour depth of 1/1 SD.
BemapleX – FOR THE HIGHEST DEMANDS WITH THE BEST EFFICIENCY

> BemapleX M-T ternary

BemapleX Yellow M-T, BemapleX Red M-T and BemapleX Navy M-T are the ternary elements of perfectly coordinated metal complex dyes with the highest light and wet fastness properties as well as an excellent, equal shade build-up for medium to dark colours.

The ternary is very suitable for printing carpets with digital spray printing processes due to the low electrolyte content and an optimised formulation; fast fixing is guaranteed, also in saturated steam. An advantage of this ternary is the colour intensity of the individual components. For this reason very deep colours can be achieved with small dye quantities, which has a positive effect on the thickener consumption and the recipe costs.

> BemapleX Black D-TR

BemapleX Black D-TR is a low-electrolyte metal complex black that is excellently suited for printing with synthetic thickeners, especially for digital spray printing on polyamide or wool. The dye is very economical and has a high light and wet fastness.

Tuft pile

- BemapleX Yellow M-T 0.85 %
- BemapleX Red M-T 0.60 %
- BemapleX Navy M-T 1.50 %

Oval pile

- Additional element: BemapleX Black D-TR 1.95 %

The figures correspond to a colour depth of 1/1 SD. Exceptions are Navy in 2/1 SD and Black in 3/1 SD.
THE PERFECT SYMBIOSIS

> EVOLUTION STEP NO. 1: OPTIMISED FORMULATION

The formulation of a dye has a considerable influence on the viscosity of the printing paste. CHT | BEZEMA does justice to this need. The optimised dyes have a lower electrolyte content than the rest of the range and therefore lower recipe costs while increasing reproducibility at the same time.

> EVOLUTION STEP NO. 2: PERFECT COMBINABILITY

Optimum combinability of the dyes is necessary to obtain good levelness and reproducible results.

When the BEMACID | BEMAPLEX dyes selected for digital spray printing are used, a perfect tone-in-tone stain is achieved between the root and tip and reproducibility is increased.

> EVOLUTION STEP NO. 3: EXCELLENT LIGHT FASTNESS

With the BEMACID | BEMAPLEX ternaries it is also possible to achieve extraordinarily high fastness properties and stable shades without a shift in colour after light exposure (Fig.).

- BEMACID E-TL
- Traditional 1
- Traditional 2
- Traditional 3
- BEMAPLEX M-T
- Traditional 4
- Traditional 5
- Traditional 6
The high demands on thickeners for digital spray printing can only be met by synthetic acrylate thickeners. The main criterion for an optimum thickener is a so-called structure viscosity accompanied by a very high purity. Only such thickeners guarantee trouble-free processing without nozzle obstruction and damage to the machine. In addition, a good thickener must have the highest possible stability towards electrolytes, promote levelness, not have any negative influence on fastness properties and must be easily washed out.

Different thickeners and printing auxiliaries are available for modern carpet printing. Various high viscosity polyacrylate thickeners have been developed under the brand name of TUBIVIS UNIQUE for digital spray printing.

**TUBIVIS UNIQUE 431**
Anionic acrylate thickener with a high purity pH value: 5.5 – 6.0 in the stock paste
Advantages: Very good swelling, stable to electrolytes, high penetration speed, sharp contours, excellently suited for very critical fixing conditions, advantageous when printing on articles with backing

**TUBIVIS UNIQUE 432**
Anionic acrylate thickener with a high purity pH value: 6.0 – 6.5 in the stock paste
Advantages: Level surface, higher print brilliance, very pure formulation, stable to electrolytes, sharp contours, highest penetration speed

**TUBIVIS UNIQUE 432 HD**
HD stands for high definition
Anionic acrylate thickener with a very high purity pH value: 6.0 – 6.5 in the stock paste
Machine suitability: HSV 400 and HSV 800
Advantages: Level surface, very high print brilliance, very pure formulation, stable to electrolytes, sharp contours, highest penetration speed
The top product for digital spray printing supplied by CHT | BEZEMA is TUBIVIS UNIQUE 432 HD which is very easily filtered and permits trouble-free operation on all digital carpet printing systems due to its high level of purity. The advantages are a previously unachieved levelness of the fabric appearance with very low product consumption. With its rheological properties TUBIVIS UNIQUE 432 HD is suitable for low to very high viscosities. The formulations of TUBIVIS UNIQUE 432 HD produce structure-viscose printing pastes with small quantities that ensure an excellent contour sharpness and a high levelness.

Advantages of TUBIVIS UNIQUE 432 HD

• Very fast and complete swelling (no subsequent swelling!)
• Promotes very fast dye fixing
• Very fast and even penetration
• Less sensitivity to dye gelling
• Promotes a level fabric appearance
• Fixing already possible with low acidity to neutral pH value
• High stability to electrolytes

**RECIPE RECOMMENDATION**

<table>
<thead>
<tr>
<th></th>
<th>Stock thickener</th>
<th>Printing paste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft water</td>
<td>x g/kg</td>
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<tr>
<td>TUBIVIS UNIQUE 432 HD*</td>
<td>10 – 15 g/kg</td>
<td>TUBIVIS UNIQUE 432 HD* stock thickener 300 – 900 g/kg</td>
</tr>
<tr>
<td>Selected BEMACID</td>
<td>BEMAPLEX dyes</td>
<td>y g/kg</td>
</tr>
<tr>
<td>Soft water</td>
<td>z g/kg</td>
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</tr>
</tbody>
</table>

5 – 10 minutes in saturated steam

* Other TUBIVIS UNIQUE types are also available depending on the requirements.
Information on fastness properties:

The stated fastness properties were determined on polyamide 6.6 and wool in the colour depth of 1/1 SD. Navy and black brands tested in concentrations normally used in practice are an exception (navy 2/1 SD, black 3/1 SD).

- Fastness to light DIN EN ISO 105-B02
- Washing fastness 40 °C (wo) DIN EN ISO 105-C06/A1S
- Washing fastness 40 °C (PA) DIN EN ISO 105-C06/A2S
- Washing fastness 50 °C DIN EN ISO 105-C06/B2S
- Fastness to water DIN EN ISO 105-E01
- Chlorinated water fastness DIN EN ISO 105-E03
- Shampooing fastness BS 1006-UK-tB

1) Method of determination: DIN EN 1485
2) The heavy metal is complexly bonded and therefore an integral part of the dye molecule

This data is given to the best of our knowledge and belief.

We provide non-binding information on our products' properties. All information is subject to change without notice.

For detailed information, questions and suggestions, further information on thickeners and dyes as well as technical support please contact the CHT BEMAPLEX specialists who will be pleased to be of assistance.

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### BEMACID

<table>
<thead>
<tr>
<th>Solubility in g/l</th>
<th>25 °C</th>
<th>35 °C</th>
<th>40 °C</th>
<th>45 °C</th>
<th>50 °C</th>
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<tr>
<td>10</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>6</td>
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<tr>
<td>30</td>
<td>6</td>
<td>4</td>
<td>3</td>
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<td>6</td>
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<thead>
<tr>
<th>Fastness in g/l/W</th>
<th>1/2</th>
<th>1/10</th>
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<tbody>
<tr>
<td>Washing fastness 40 °C</td>
<td>CC</td>
<td>WO</td>
</tr>
<tr>
<td>WC</td>
<td>PA</td>
<td></td>
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<tr>
<td>CD</td>
<td>CD</td>
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</table>

<table>
<thead>
<tr>
<th>Chlorinated water fastness in mg/l</th>
<th>CC</th>
<th>WO</th>
<th>PA</th>
<th>CD</th>
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</thead>
<tbody>
<tr>
<td>12.0 free</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>1.5 free</td>
<td>3</td>
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### BEMAPLEX

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</tr>
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<td>PA</td>
<td></td>
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<td>CD</td>
<td>CD</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Chlorinated water fastness in mg/l</th>
<th>CC</th>
<th>WO</th>
<th>PA</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.0 free</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>1.5 free</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
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**Competence Overview**

Advanced

Improved and adapted ranges for versatile and economical use, which meet high requirements.