New Developments in Finishing of Fabrics and Nonwovens

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Introduction

Nonwoven coloration, coating, and finishing applications and traditional textile applications have a lot in common. In each case, the substrates are enhanced by color and finishes that create aesthetics and key performance requirements. This paper will describe recent advancements that allow both color and coating/finishes to be applied simultaneously with greater efficiency than ever before.

BASF Color Fast Finish

All manufacturers of nonwoven technical textile products operate under the same costs demands as traditional textile manufacturers. The need, even the absolute requirement, for speedy delivery, low costs, and ease of handling in manufacturing are a must in today’s business world. Suppliers of these products are learning that quick response, especially to reorders, is the key to profitable and continuing business.

The process identified above is a major enhancement of a process that has been used in both textiles and nonwoven wet processing for many years. As early as the mid 60s, bed sheeting was being dyed with a one step, dyeing and finishing process. Many problems existed then and have lingered with traditional systems. Problems were poor color fastness and limited color depths available. Bigger problems were internal handling issues with chemical/color build up on machinery. Clean ups were a source of major downtime and contamination of future shades was always a concern.

What’s changed, you ask? About everything is the answer. The question kept coming back to my company is “Why can’t we overcome the problems with this one step color/coating/finishing process.” It seems such a “no brainer” that a smooth operating one step system would provide the industry with the advantage it needs to compete more aggressively in the marketplace. We set about to evaluate all the basic known chemistries used traditionally and see what improvements can be made. We then looked to bring in other chemistries that might enhance color fastness or make recipes run better. We looked at process conditions and studied the equipment to see what arrangements would be optimal.

The varying performance requirements being asked for by the marketplace create the biggest challenge. Some end products require flame retardants, some soil release characteristics, some high light fastness, and colors of the wildest imagination. Getting all these chemistries to mix and be compatible has been a major challenge.
Chemistry, Requirements and Options

The need to be able to put varying chemistries together more successfully drove the need for unique compatibilizers. We developed special surfactant systems to address these issues. There are special cases when we can incorporate both anionic and cationic products in the same bath and produce good stability and no running problems. These products have flexibility to allow foaming or padding applications to run clean and efficiently.

Colors used for these systems have traditionally been pigments. In past times, the same colors used in printing were transferred to the one step applications. Usually, these were met with short term disasters or long term disappointments. Pigment colors for printing processes are designed to “lay on top of the substrate” in order to produce maximum color yield. This is done by grinding pigment press cakes to a relative large particle size. Large particle size pigments lay nicely on the surface of substrates, but due to predominately surface applications, the color is more easily rubbed off. The improvement in pigments has come from selectively grinding press cakes to very small particle sizes. This way pigment particles can penetrate into the substrate to apply color throughout the substrate/coating package. Rub fastness and crocking tests are greatly improved by use of these special pigments.

Pigment colors are held in place by a variety of binder systems. Significant improvements have been made in softness, runability, and fastness of these binder systems. Most substrate handle request, from soft to very firm are within the window of possibilities. Binder choices are established by vendor/manufacturer discussions and proper development.

Migration control of the color of one-step systems is more sensitive than conventional drying without color. Even the application uniformity of coatings and finishes is dependent on careful control of initial heat applied to this chemistry. Special antimigrants have been developed to optimize the application of these complex combination chemistry packages. In many cases these special antimigrants can act in synergy with other chemistries to produce enhanced effects.

Special additives, i.e. flame retardants, soil release chemistries, and other special effects can be added as needed. As always with chemistry, tests should be made on a lab scale to determine the compatibility of individual products and systems.

Machinery Considerations

Application machinery variations create special challenges for these one step systems. The need for careful initial exposure to heat is critical. There are a variety of methods and equipment arrangements that can be successfully used. Again, individual discussions are the key to gaining the information needed for optimum results. Anyone considering setting up or modifying an existing range should be openminded about the advantages of this new one-step system and investigate options with equipment and vendor experts.

Most equipment in place in the coatings industry can be used as it or easily converted. Development work is being done with radio frequency to study the possibilities to improve predrying and drying processes. Migration of color and certain additives are more easily controlled with such systems, thus enhanced performance.

The new one step system is also great for small lot sizes with some special adaptations to mix making set ups. For instance, if a manufacturer wants to product 1000 yards of 5 colors with
the same chemistry recipe, he can make enough base mix (without color) in a large tank. Then drop the amount needed for each color into a smaller side tank, add the needed color and proceed. Cleanup up is easier than before and down time between colors is minimized.

Summary

Textile users of this process have realized significant savings in time, labor, energy consumption and with greatly reduced water consumption over conventional processes. Plant managers testify that the best advantage of this system is the speed and flexibility it affords. As the NAFTA market place continues to be challenged by offshore products, it is expedient that we pursue all possibilities to remain competitive. No substrate limitation has been realized to date. One step coloration and coating is ready to take its place.
New Developments in Finishing of Fabrics and Nonwovens

Major Improvements have been made to allow greater use of color in coating and finishing of Nonwovens.

Productivity and Costs advantages more achievable.
BASF Color Fast Finish
INNOVATIVE PROCESS

Single step process saves:

- Time
- Energy
- Labor
- Water

ECO Friendly Process: Conforms to Oeko-Tex Standard 100
History-Application & Issues

Pigment colors have been added to finishes and coatings for many years

Problems were:

- Limited shade depth and brightness of color
- Color fastness
- Handling problems
- Clean up problems
- A “Low quality mindset for use of Pigments”
The quality of pigments: Manufacturing techniques improved

The discovery of unique compatibilizers that keep the differing Chemistries in the bath “happy.”

Improved binder systems that enhance fastness and handle

Unique migration control products that promote penetration Throughout the substrate

Better understanding of the role of pH in the bath and the Development of control methods.
Machinery Considerations

CFF is suitable for padding, coating, and foaming

Traditional padding equipment with good side, center, side control is sufficient and necessary

Coating via all know methods is suitable

Foam coating is especially applicable.

GASTON SYSTEMs Parabolic units are well suited
Typical Production Set-up

Prepare “Master Batch recipe” without color in larger vessel

Drop Master Batch into smaller tank, then add desired colors
   (Locate smaller tank very near application unit so plumbing distance is minimized)

Run scheduled fabrics at padder or coating unit.

Clean small tank and pad immediately with copious flushing.

Drop needed Master Batch down again for next scheduled Lot, add next color and proceed, etc
Predrying and Drying Considerations

Initial drying is a critical step. The Migration control system needs to achieve a quick jump to 125-135F fabric temperature for best results.

Drying and curing then can be adjusted to crosslink the chemistries included in the recipe.
BASF Color Fast Finish
General

- Suitable for producing pastel, light and medium depths of shade on
  - Woven
  - Bulky fabrics e.g. knits
  - Nonwoven Fabrics

- All fabrics of natural and synthetic fibres and their blends can be finished

- Excellent levelness and fastness

- Soft, smooth handle with uniform coloration
BASF Color Fast Finish
Benefits

- Easy and quick one step coloration and finishing
  - Pad liquors are easily prepared at room temperature
  - Excellent bath stability
  - Overprinting after finishing often possible

- Economic and simple
  - Drying and curing is carried out in one step
  - Great savings in water, chemicals and energy
  - Minimal equipment needed (padder, pre-dryer, stenter)
**BASF Color Fast Finish Benefits**

- **Environmental protection**
  - Colors are applied and dried are final in shade
  - No developing operations are necessary
  - No after-wash or after treatment is required
  - Virtually no effluent impact

- **Versatile**
  - The system can be run as a non-resinated formula or a full finish formula
BASF Color Fast Finish

Fastness

- Excellent fastness both to washing and scrubbing when used in conjunction with proper auxiliaries
- Excellent fastness to light in many colors
- Excellent fastness of selected colors to
  - Chlorine
  - Dry cleaning
  - Perspiration
  - Gas fading
BASF Color Fast Finish Products

- Helizarin® Binder PAD N
  - Very soft non-yellowing binder

- Siligen® PAD
  - Unique antimigrant system

- BASF Pad N® Colorants
  - Nonionic, aqueous dispersion and pigment preparation
BASF Color Fast Finish Products

- Keralon® JET B Conc.
  - Compatibilizer

- Additive
  - Siligen® SIN, silicone softener
  - Siligen® VN, secondary polyethylene dispersion
  - Siligen N-SIH, hydrophilic softener (towels)

- Fixapret® CL
  - Extremely low-formaldehyde resin

- Catalyst ® MC
BASF Color Fast Finish
Formulation without resin finishing

- General recipe:
  - 1.0-2.0 g/l Kieralon® JET-B Conc.
  - 20.0-40.0 g/l Helizarin® Binder PAD N
  - 0.1-20.0 g/l BASF PAD N® Colorants
  - 5.0-20.0 g/l Siligen® PAD
  - 5.0-10.0 g/l Glauber Salt (pre-dissolved)

- Pick-up: 30-70 % dependent on the type and construction of the fabric

- Drying: 100-120°C

- Curing: As a rule 30-45 s at 170°C
BASF Color Fast Finish
Formulation with resin finishing

- General recipe:
  1.0-2.0  g/l  Kieralon® JET-B Conc.
  20.0-40.0  g/l  Helizarin® Binder PAD N
  20.0-30.0  g/l  Fixapret® CL
  .0-30.0  g/l  Siligen® VN
  .0-10.0  g/l  Siligen® SIN
  0.1-20.0  g/l  BASF PAD N® Colorants
  5.0-20.0  g/l  Siligen® PAD
  5.0-10.0  g/l  Glauber Salt (pre-dissolved)
  5.0-10.0  g/l  Catalyst® MC (pre-diluted)

- Pick-up: 30-70 % (dependent on the type of fabric)
- Drying: 100-120° C
- Curing: 30-45 s at 170° C
COLOR FAST FINISH-SUMMARY

THIS ONE STEP COLORATION SYSTEM offers constructive Options our NAFTA manufacturing partners to increase their Competitiveness and Profitability.

“THANK YOU”

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