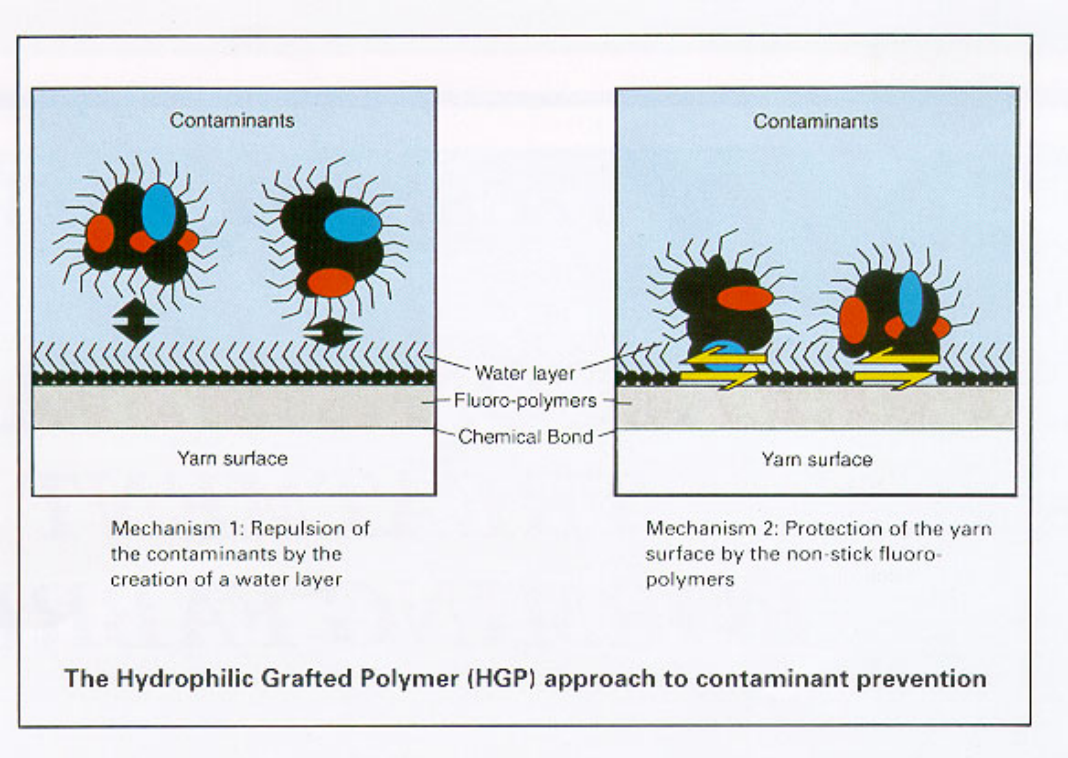
Polymer-Grafted Forming Fabrics



The Hydrophilic Grafted Polymer (HGP) approach to contaminant prevention

Those Xerium companies which are major suppliers of forming fabrics to the paper industry – Weavexx (North America) and Huyck – are addressing the problems caused by recycling practices which have resulted in contamination of their products by pitch, adhesives and ink.

In 1990, Weavexx entered into a joint research project with the Polymer Research Corporation of America to develop a process that would overcome loss of performance of forming fabric due to contamination.

To meet the needs of its customers, Weavexx's criteria for the design of any new process was that it should not:

- Alter water drainage through the fabric pores
- Affect shape or size of the pores
- Affect current wear or abrasion resistance
- Affect paper sheet release properties
- Cause fabric stretch (or reduce stretch resistance)
- Degrade under papermaking conditions (should be stable)
- Release toxins, carcinogens or sin irritants

It should, however, be capable of application on existing finishing machines under safe conditions without extensive ventilation and should not expel toxic fumes or present a fire hazard. Furthermore, it should mean that no extra disposal systems (other than those currently used) should be necessary while at the same time meeting State and Federal environmental and disposal requirements.

The HGP Process

After extensive research, the result is a specially formulated treatment, which is chemically grafted and cross-linked to the polyester yarns used to manufacture the woven structure of the forming fabric.

Called the HGP (Hydrophilic Grafted Polymer) process, it provides a state-of-the-art barrier between the forming fabric structure and the contaminants coming from the recycled material.

It is highly effective in resisting the buildup on the fabric surface of inks and adhesives that may be present in recycled fiber and also the pitch in virgin pulp.

Pitch is most commonly a problem in virgin stock and results from the incomplete removal of the resinous materials during the pulping of some wood species. It can be seasonal in nature (where a mill changes supply during the year or when the mill begins to receive wood cut when the sap was raised in the tree).

Adhesives arise from the use of recycle paper. They usually fall into two classes. Firstly, pressure sensitive adhesives used in mailing labels and self-sticking notes, which are broken up in the re-pulping process into small particles that settle in the pores of the forming fabric during papermaking and can be very difficult to dislodge. Secondly, hot melt adhesives, used in book and magazine bindings and in corrugated box assembly, which can degrade and become soft during re-pulping. The softened adhesives can plug the fabric, resulting in reduced drainage that can transfer to the paper sheet as pinholes.

Inspecting the forming fabric

Ink from recycled newsprint is a major contaminant because even the best deinking plants cannot achieve 100% removal of the ink in the stock. Any remaining ink above 0.5% sticks to the fabric and causes a gradual reduction in drainage and fabric performance.

Description of Chemistry

The surface of forming fabrics can be changed to provide anti-stick properties by:

- Blending additives into the yarn during the extrusion process
- Coating the original yarn or woven structure
- Chemical modification

Additives, when blended throughout the yarn, can only be used in small quantities otherwise the fabric's physical properties deteriorate. Therefore, only an ineffective amount of the anti-stick agent may be present at the surface of the yarn where it is needed.

While coatings can be applied to either the fabric or yarn, they are only stuck to the surface and may peel, flake or wash off. Also it is often inherently difficult to get anti-stick chemicals to adhere to the fabric.

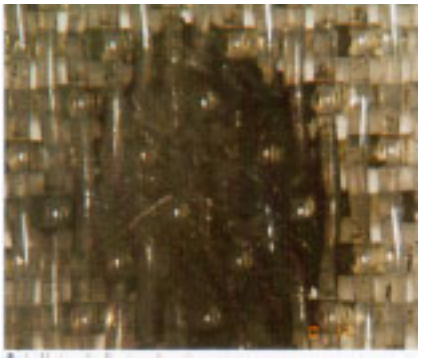
The HGP process is neither an additive nor a coating. The process chemically bonds and cross-links various monomers and fluoro-polymers to the yarn in such a way that they become an integral part of the yarn surface. This results in highly effective contaminant-resistant properties that last the life of the fabric.

HGP achieves its effectiveness by reducing the strength of any bonds between the fabric surface and the contaminants in the stock. Contaminants do not adhere or are easily showered away. To accomplish this, HGP uses a two-fold approach (see main picture). The outer surface of the fabric is made hydrophilic and attracts a layer of water molecules that shields the fabric from contaminants. Beneath this and attached to the surface of the fabric is a fluoro-polymer which prevents particles from attaching to the fabric if they penetrate the outer layer.

Testing in Depth

HGP has been extensively tested in the laboratory and in the field. These tests have been designed to evaluate effectiveness against the various classes of contaminants and permanence under the conditions found on the papermaking machine.

A peel test was developed to measure the resistance to contamination by adhesives and to assess the permanence of the treatment. In it, a standard tape is applied to a sample of fabric and the force required to peel it off the fabric is measured. That force is compared with that of an untreated fabric. The test is repeated 8-10 times with fresh tape on a fabric sample to measure the permanence. The test gives very repeatable results that correspond to experience in the field.



Typical hot melt adhesives deposit

Laboratory deposition tests were used to evaluate the performance against deinked newsprint. For this test, samples of heavily inked newspaper are mixed with mailing labels and re-pulped. The mixture is pH adjusted and heated. Pine tar is added to the stock to evaluate effectiveness against pitch. Several test samples and control fabrics are suspended in the agitated pulp. The samples are evaluated visually by counting under a microscope the number of points of contamination.

White-water testing has been used to give confirmation of laboratory results. Fabric samples were hung on metal frames suspended in the white-water system of a paper machine. Typically, the samples remained in the pit for two weeks and were then compared with control fabrics to evaluate effectiveness. Image analysis was used to quantify the reduction in contamination.

Conclusion

Several HGP treated fabrics have now run on paper machines in the United States, Canada and Europe. These field experiments have confirmed the laboratory findings that HGP reduces pitch, ink adhesives and latex contamination of fabrics and furthers the production of recycled newsprint, fine paper and tissue under acidic stock conditions.

Other findings indicate the HGP treatment appears to reduce starch contamination under slightly alkaline conditions. It may also reduce pitch dispersant consumption in recycled tissue applications with acidic stock.

Encouraged by these results, Weavexx researchers are continuing to evaluate new applications for the HGP process.

Company Profile

Weavexx is one of the leading paper machine clothing manufacturers in North America. It makes a complete range of paper machine clothing from forming fabrics to press felts and dryer fabrics. It also manufactures associated drainage equipment for paper machines.