Possibilities and advantages provided to the paper maker by the nowo–former

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Paper makers have always been busy to produce new products of still higher quality even more efficiently and more economically, thus participating in the growing markets. With mass papers, these growth rates resulted in huge production facilities and concentrations and for many a paper maker this meant a struggle just to survive.

A number of medium-sized and smaller companies specialized, finding market niches and filling them successfully, by successfully applying new fibres and creating products with new properties.

Manila hemp and similar fibres are not only to be used for making nice hula skirts, but these high-grade long fibres offer a wide range of possibilities.

Such fibres can bring a lot of trouble on a normal fourdrinier, but on the NoWo-Former, our inclined wire machine, these fibres can be processed into a great variety of high - quality products.

Inclined wire or wet laid nonwoven machines-are applied to produce long fibre products.

Long fibres could cover the whole range from pulp via rayon, polyester, polyamide, polypropylene, aramide down to mineral fibres, like stone, glass or even steel fibres.

Long fibres are to be understood as fibres having a length of in between 1 and 30mm, thus having a multiple length of the fibres normally used in paper production.

The big advantage of producing nonwovens in a wet system rests in the use of relatively cheap pulp instead of expensive synthetic fibres. On the other hand the use of mineral or other technical fibres and the possibility to use recycled fibres instead of new native fibres. These advantages cannot be realized with any other process in the nonwoven production, as dry-laids, spun-bonded or perfojet nonwovens.

To form these fiberes into a web they must be separated from each other by higher volumes of water, i e. these machines must be fed with suspension volumes that are at least ten times higher than on a paper machine.

These huge amounts of water cannot anymore be put onto a fourdrinier wire through a slice as deceleration/acceleration of the different layers in the following dewatering would cause a shifting in the sneet structure resulting in an uneven fibre mat.

For this reason, forming of a fibre mat on an inclined wire machine is achieved directly out of the suspension in a filtration process, in which a number of layers in fibre thickness build up on each other.

The fibres are drawn to the wire out of the moving suspension and are fixed as a filter mat.

The arriving suspension has to be directed into travel directed into travel direction of the wire and one has to take care that at the time of the mat build-up the suspension speed is equal to the wire speed. By that only a little percentage of fibres is orientated in the z—direction.

The production of multi-ply nonwovens is also possible by arranging several headboxes on top of each other and produce a web on wet basis. On this type of

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machines nonwovens with different characteristics on the surfaces can be composed, for instance a pulp sheet with a heat-sealable surface.

By further application of vacuum, the nonwovens are brought to a dry content up to 25-30% on the wire section.

The further drying prosess is completely dependent on the type of product one wants to make and can be either realised by pressing followed by a plain dryer section, as a air-through drying process, or a combination of both, whereas the type of drying naturally influences the characteristics of the finish products.

The application of the machine and its design is greatly influenced by the product to be made. The range is wide from simple machines to produce glass mats for roofing via combined machines to produce filters, disposables, or converstock up to highly developed machines to produce very expensive steel or submicron glass filter and isolation mate .

So, let's have a look now at the great versatilioty of fibres and products therefrom.

The application of nonwovens from long-fiber stock can be divided into 3 main fields :

A. textile nonwovens

B. long—fiber paper

C. Technical long-fiber nonwovens

A. TEXTILE NONWOVENS

In the range of *textile nonwovens* for clothes or interlining, the share of the wet—laid nonwovens is rather moderate compared to the other manufacturing processes, but very promising.

B. LONG—FIBER PAPER

Certainly, there is widest field of application for inclined wire machines today.

When the British used in their Spitfire combat planes seats of high-strength long-fiber paper made by Crompton paper mills already in World War II, this material was applied to make the plane a little bit lighter, a little bit faster, a little bit better responding. allowing it to stay ali ttle bit longer in the air, sometimes a factor of vital importance. Together with further weight reductions, it was less heavy than a full metal construction.

Now, let's have a look at the *Manila hemp fibers* and their most typical application-the tea bag. Today, the base paper is produced in two versions. One version is singleply, the second being double-ply.

One is not heat sealing and is converted into folding bags while the second version, with the 2nd layer consisting of bonding fibres, is heat sealing, being the base paper for the so-called floating bags. Coffee filter paper etc. are (very often) produced on the inclined wire and so are filter bags for vacuum cleaners and air filters for automobile industry. Oil filter papers are often double-ply, e.g. mixtures from long-fiber pulps and linters and glassfibers in the top layer. The market would be unthinkable without such product today.

Another interesting application in food industry is the field of sausage casings. Besides the fact that we in the western world do not have enough natural material for this, the big advantage is a very easy and quick filling of sausage casings durings sausage production and as they always have the same diameter, cutting slices of the same thickness always gives the same weight.

And their is the nonwoven sector for *hospital and private requirement*. Surgeon's clothes and protective clothes for industry of this material are a matter of course today and so are *blankets*.

As far as the baby napkins are concerned, one can speak of hightech for baby's bottom as mentioned in no. 13 news selease on the occasion of index 90 (modern nonwoven compounds for sanitary application wet-laid coverstack, absorbent layer of (fluff pulp, back of waterproof foil).

Wipes produced by the wet process, i.e. on the inclined wire', represent a big market with heavy growth rates, why not produce them on the paper machine ? Simple because of the fact that long fibers with a length of up to 24 mm would be a great problem there—because of 'spinnig'. No such problem on the NoWo-Former which is designed so as to manage even very high dilutions in a reproducible, efficient way. And then you can produce nonwovens with textile touch with job-specific quite different properties. Be it for cleaning of windows or plastic components in a motorcar factory before final inspection or for removing excess grease or oil etc.

A study by Froest & Sullivan on nonwoven wipes shows an EC market of 400 million dollars. The per capita consumption in Scandinavia and America in this market sector is considerably higher, showing that there is still a big growth potential for wipes in the EC. We could imagine that this growth potential for 'wet-laid' wipes will even increase in future. Why ? Simply because recyclying is no problem when using suitable binders. In any case, textile-type long-fiber waste can be recycled and this is a very important point today.

C. TECHNICAL LONG-FIBER NONWOVENS

Now, let's have a look at the 3rd field the field of *technical long fiber nonwovens.*

Formerly, roofiing felt was produced from board. Today, board has been fully replaced by nonwovens of glass fibers and/or polyster fibres in this product group, because glass-reinforced roofing felt is noncorroding and of high dimensional stability and can be produced at considerably higher production speeds (easier to impregnate with bitumen/asphalt).

In the U.S.A., shingles have a very big market. Shingles correspond to our tiles, punched in tile from glass reinforced bitumen / asphalt mats. The substantial advantage compared to conventional tiles is the lower weight, allowing less heavy and less expensive roof constructions, faster laying and improved heat insulation.

In *carpet production, glassmats* have replaced the conventional carpet backing, are more and more used as well covering instead of wall paper or textile hangings in offices and even in private homes.

Such glassmats produced by the wet process are used in laminates in the resin rich layer in boat building car body building, in swimming pools etc., in batteries they gradually replace conventional seperators, for electronic industry such glassmats are impregnated with epoxy-resin and processed into printed circuit boards etc. All those markets are furnished with products that can be produced on the nowo-Former.

Today, we reduce weight of cars by replacing steel and sheet metal by fiber-reinforced plastics-to reduce fuel consumption (better economy) and for less pollution and to make them better performing generally. so fenders, rear flaps and engine bonnets as well as a lot of components inside the car are made of fiber-reinforced plastics today. High-tech. fibers, such as aromatic polyamides and carbon fibers will increasingly be used in future. These fibers can be processed into nonwovens of high-strength laminates for the most different applications, e.g. brake lingings (to replace asbestos) etc.

Nowovens on the basis of ceramic fibers are being used for high-temperature insulations and filters as a substitute for asbestos base material and admixtures and linings for hightemperature furnaces.

When talking of high-tech. we have to mention two more markets :

Filtration and the high-tech. composite material (for reinforcement purposes).

Clean room technology is a relatively young field Some time ago, ambient air containing 100.000 particles per cubic foot (28 liters) was considered extremely clean. In the production of 1 Mega-bit micro-chips a particle of approx. 0.1 per cubic foot can be tolerated at a clean-room working place at the most. In the production of the 4 Mega-bit chips, such heavily polluted and insufficiently unacceptable. Here the max, tolerable particle size is reduced to approx. 0.05 μ

If high-efficiency particulate air filter paper and to an increasing extent ultra low pentetration air filter paper with separating degrees of 99.95—99,9999% at a particle size of 0.12 μ are the solution to sufficiently clean air at such clean-room working places today, new top achievements for tomorrow are required already today. High-efficiency particulate air filter paper and ultra low penetration air filter paper could be built-up with the following glass fibers and glass fiber mixtures.

reinforcing fibers	4μ
coarse fibers	2—4μ
micro glass fibers	0.05—2μ
submicro glass fibers	0.05μ

With a top layer, the filter paper surface can be modified accordingly to meet the most versatile applications.

Reinforcement of plastics by high-modules fibers (graphite, aromatic poliyamide) is a very young field of application for nonwovens. New materials which perhaps will change the future in the same way as the computer did so far. Among other advantages, these new materials offer the advantage of maximum strength at minimum weight.

To achieve such properties in a technically reproducible way, the fibers must be positioned in x-y-z-direction in a predesigned way in order to optimally transfer the forces applied to the laminate (or hybrid) produced therefrom. Here, the Nowo-Former offeres optimal solutions, allowing for MD and CD fiber orientation of practically 1 : 1 up to expressed MD orientation, without leading to uni-directional fiber orientation.

By adjusting dewatering conditions in the NoWo-Former fiber orientation in z-direction can be controlled, too, this being of great importance when producing multi-layer nonwovens with reinforcement properties Contrary to wipes, the structure of the fibers and their orientation is the key factor when producing products with reinforcement properties and can be put on a level with success or failure.

That's why we produce multi-layer nonwovens on our NoWo-Former wet in wet, resulting in a homogenous fiber build up throughout the nonwoven. (Fibers in x-y-z- direction). A multi-layer nonwovens produced this way will absorb uniformely the reinforcing polymers. The calculated forces can be absorbed and transferred thus using the excellent high strength properties of these very expensive high-tech. fibers.

Matters are different when adding another layer into a nonwoven already stablized on the wire. Then there will be no anchoring of fibers from upper layer into lower layer, but this will only give a x-y-z-direction fiber orientation. Only with further build-up in thickness x-y-z- fibers orientation develops. And What is the result of this difference ? Although a multi-layer nonwoven produced this way looks very nice, it implies a latent risk. Failure due to delamination under load. Exactly where the wet on dry built up layers starts, resin rich (polymer rich) layers may occur which have only negligibly low mechanical properties compared to the surrounding hybrid material.

These low-strength areas will fail quickly under stress and strain (static and dynamic) and the created defect damages the surrounding laminate/hybrid areas, a.s o. But as mentioned before, you can also work 'wet-in-wet'.

When NEUE BRUDERHAUS Maschinenfabrick GmbH designs a NoWo-Former, we study the properties of the final product and the fibers as well as bonding material to be used for this job. According to the findings, we build the NoWo-Former around the fibers to achieve thg required properties the best way possible. This means, we form a team with nonwoven makers and sometimes even with the raw material suppliers to develop the best tailored solution possible.

For product development and basic tests for our customers we have developed a little laboratory inclined wire machine, on which we can test the application of the different fibers, their binder capacities and the different mixtures. This laboratory is open to any of our customers for principle trials. Some of the fiber suppliers. however, have purchased their own laboratory machines to relieve their production machines from costly trials. We are ready to build machine for laboratories in two different widths, i.e. with 300 or with 600 mm, including binder applicators and dryers.

All the experience gained from the different fields are complied at NBM. The resulting know how is used for further development of our products and progress in papermaking, nonwoven and finishing technology.