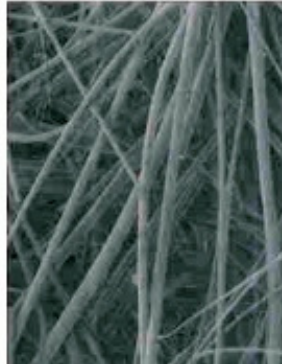


The Spin Zone — The Last Controlling Influence of Fiber Quality

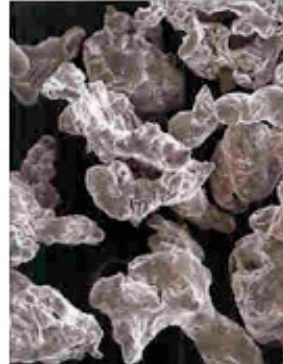
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Screen packs



Nonwoven fiber metal felt



Shattered metal

Today the only constant in the fiber industry seems to be change, where global competition has led to dramatic shifts in the manufacturing landscape. Yet despite these shifts, growth in demand for man-made fibers continues to be strong worldwide. While these market changes appear to be unstoppable, fiber producers are finding ways to be profitable through product innovation and adaptation to niche markets.

As fiber producers are moving higher up the "value" chain, they are frequently confronted with a whole new set of processing challenges. Process parameters that were originally adopted for commodity or high volume applications may no longer be suitable for more demanding products. New polymer additives, finer deniers, complex filament profiles, and often shorter production runs, all add to the challenges that fiber producers face today.

SPIN PACK

At the heart of the fiber spinning process is the spin pack. Often overlooked, the spin pack is the last controlling influence for fiber quality and production yields. Within the spin pack, a number of dynamics play out, which can have dramatic influence on bottom line economics. Critical factors such as polymer residence time, flux/shear rates, flow distribution, gel capture/control, and ultimate filtration levels all must be balanced to optimize fiber spinning. Controls of both internal and external pack leaks are also vital components to economic success.

So, given these many challenges, how can fiber producers find their own "sweet spot" to maximize product quality and yields? The answer is seldom obvious, but lies ultimately in finding the right combination of internal spin pack components. These tools include: loose wire mesh (both Square and Dutch weaves), sintered mesh, nonwoven media, shattered metal, and sintered shattered metal. These various media must all be properly integrated with an array of seals and gaskets to reduce the possibility of internal and external pack leaks under operating pressures that may approach levels as high as 7,000 psi.

THE WORKHORSE

For many years the workhorse of the fibers industry has been woven wire mesh. Wire mesh offers an economic and dependable mechanism for controlling the ultimate filtration level with the spin pack. Square weaves are available in micron ranges from 25 to 2500 microns. Dutch weaves are available in micron ranges from 8 to 300 microns. Along with relatively low cost, wire mesh has the advantage of lower pressures drops when compared to alternative media. Unfortunately, by itself, woven wire mesh offers very little depth, polymer shear, and gel retention capabilities. For this reason, mesh is often utilized in conjunction with a depth media such as shattered metal. Also, due to the very fine wires used to produce the finer grades of woven mesh, pore structure can be affected by high operating pressures. Providing a

proper downstream support grid with coarser mesh layers is very important to ensure that the pore structure of fine mesh layers is maintained. In some cases, sintering of mesh layers should be considered to provide greater dimensional stability. Sintering is a process that uses heat and pressure to bond mesh wires together, providing a very rigid and stable filtration grid. Lastly, when using multiple layers of mesh, consideration should be given to staging of the mesh layers, from coarse to fine, so as to add greater depth and dirt holding capacity.

SHATTERED METAL

As referenced earlier, loose shattered metal, also called metal sand, is often used in conjunction with wire mesh to provide additional depth, shear, and filtration within the spin pack. Shattered metal, by virtue of its particle geometry, provides an excellent mechanism for gel control and also greatly increases the total filtration surface area within the pack. When using shattered metal, careful consideration should be given to the alloy used and also particle size. Alloy selection is typically determined by polymer characteristics and also the end use of the fiber itself. Today, alloys are available, which are specifically made for spin pack applications. These alloys are engineered to provide low oxidation under heat exposure, resistance to particle fracture, and resistance to particle compaction. Choosing the right particle size is also critical and can have a significant influence on pressure drop and filtration levels within the pack. The pressure drop across a bed of shattered metal is directly related to media depth. As depth doubles, so does pressure drop.

NONWOVEN SINTERED METAL

Another alternative to woven wire mesh and increasingly popular among fiber producers, nonwoven sintered metal media can provide a strategic advantage for more demanding spinning operations. Nonwoven media range from 3 to 100 microns. Although much more expensive than woven mesh, nonwoven media offers superior dirt holding capacity and gel control by virtue of the tortuous path created by an array of very fine, randomly oriented metal fibers. Sintering of metal fibers ensures a very stable pore structure and reduces the possibility of loose wires migrating to the spinnerette capillary. Nonwoven sintered media are available in both "graded" and "uniform" pore structure. Graded media offers increased dirt holding capacity, while the uniform pore structure is a lower cost option for less demanding applications. It should be noted that pressure drop across non-woven media is typically quite a bit more than the pressure drop across woven mesh of equal micron rating. Also in most cases, nonwoven media will require a downstream support grid of wire mesh to provide added stability under high operating pressures.

SINTERED SHATTERED METAL

In the same family as shattered metal, sintered shattered metal products offer the shearing benefits of loose metal powder, but in a compacted and pre-formed package. Sintered shattered metal elements are made by compressing and sintering loose powdered metal. When made into a cylindrical or candle configuration, multiple elements can be press fit or screwed into a breaker plate, offering a tremendous increase in filtration surface area and potential pack life increase. Sintered shattered metal elements are also at the top of the filtration pyramid when it comes to gel control.

Needless to say, the choice of which media, or combinations of media to utilize in the spin pack can be very involved. The solution can be visualized as a three legged stool, where spin pack life, cost of consumables, and fiber quality all have to be considered. Only when this balance is properly obtained can producers build a solid foundation for economic success.

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