InnovaNet Technology Group

April 18, 2011

Nylon in Synthetic Turf

Nylon, invented in 1935 is one of the most widely used synthetic polymers ever invented. It is versatile, durable and functional. Uses range from fibers and fabrics to structural components for vehicles. In fibers and fabrics it was originally used for parachute cloth and fine textiles. In fact " nylons" became synonymous with for women's hosiery. It has been the synthetic fiber of choice for carpet since the 1950's. It was selected as the original fiber for synthetic turf in 1965.

The benefits of nylon are numerous. It is one of the strongest synthetic fibers available, is very durable, abrasion resistant and resilient. Compared to polyethylene nylon is stronger, more abrasion resistant, more resilient and more durable. It has less market share in the synthetic turf industry simply because it is a more expensive fiber. Yet the market has more experience with nylon turf that with any other fiber. Nylon was the first turf fiber used to manufacture artificial turf. Chemstrand, a division of Monsanto, selected nylon because of its outstanding durability and performance characteristics. It was Chemstrand that designed and built the first synthetic turf installation in the Astrodome in 1965. Of course synthetic turf has evolved considerably since that time. Now nylon turf is much safer and easier to play on.

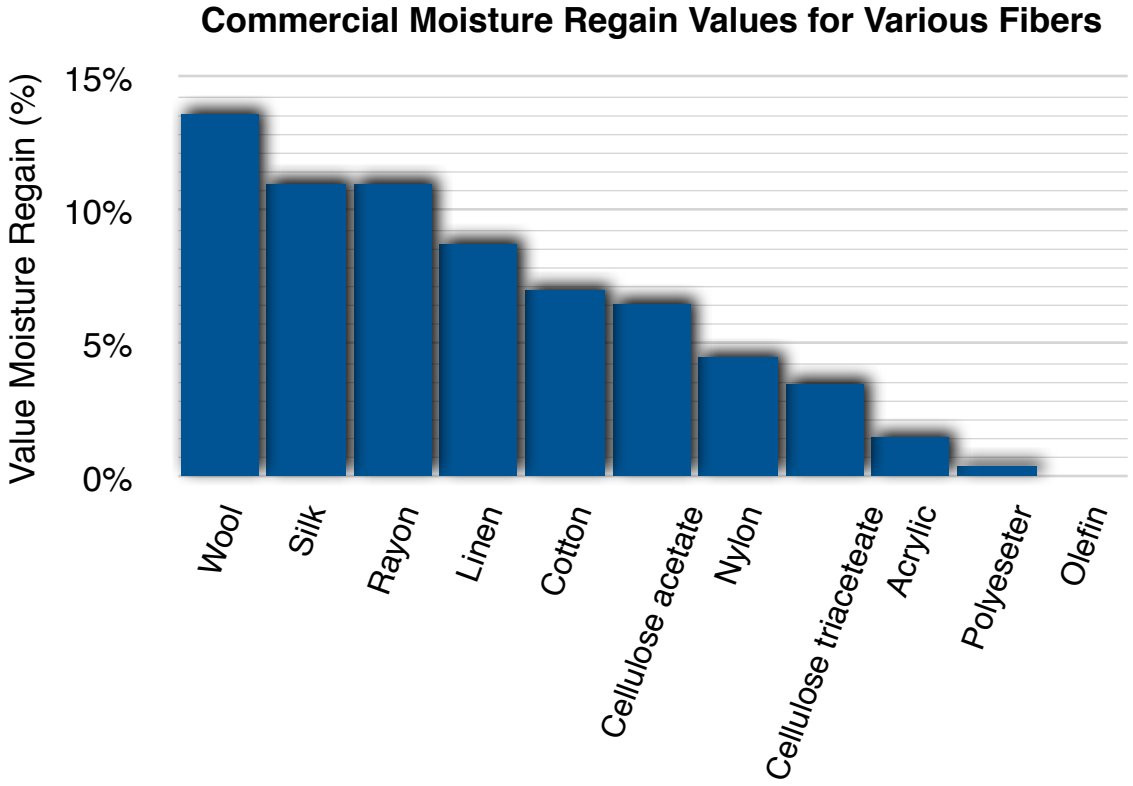
Concerns are sometimes raised about the hygroscopic nature of nylon relative to polyethylene. Hygroscopy is the tendency of a material to attract and retain water at a molecular level. It is related to the molecular structure of the material. Some molecular structures are more adept at attracting and retaining water than others. Hygroscopy therefore is a matter of degree. Wool is the most hygroscopic fiber because its molecular structure is most capable of attracting and binding water. Cotton, silk and rayon are hygroscopic as well.

Hygroscopic fibers such as cotton and wool will also have a degree of hydrophilicity (water attracting character). The fact that cotton fabrics are more water absorbent than nylon or polyethylene fabrics is due primarily to the relative hydrophilicity of the materials. It is not due to hygroscopy.

Unlike cotton or wool polyethylene is hydrophobic (water resisting) and oleophilic (oil attracting). Nylon is slightly more hydrophilic than polyethylene but much less than cotton or wool. That is, it does not readily absorb water. Nor does it readily absorb oil. This is one reason why nylon fabrics are preferred by athletes to wick moisture away from the body.

An important point for all fibers that are hygroscopic is that for every material there can only be a fixed amount of retained water and that this water will be molecularly bound inside the fiber structure. This entrained water is very difficult to remove precisely because it is molecularly bound. In order for a hygroscopic fiber to release this water it must be heated for an extended period of time at or above the boiling point of water. Thus the fiber is made to be “bone dry”.

The ability to dry fibers to a bone dry state enables the measurement of the degree of hygroscopy. In fiber technology this is typically measured as moisture regain, the amount of moisture that is absorbed by a bone dry fiber in a 65% RH environment. A comparison of moisture regain in various fibers is shown below:

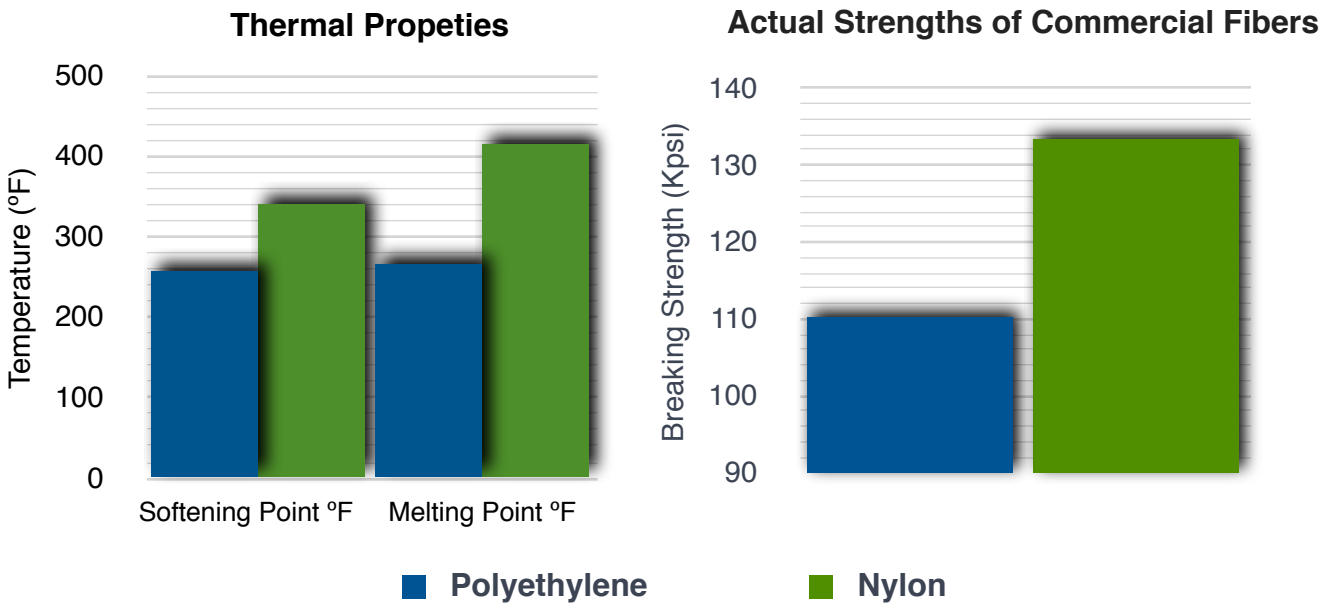


While nylon does have a higher moisture regain than olefins (polyethylene and polypropylene) it is not one of the more hygroscopic fibers. Wool is the most hygroscopic fiber and will always contains at least 13-14% water at 65% relative humidity. Yet wool fabrics feel dry to the touch. Likewise all fibers that have a relatively high moisture regain feel dry to the touch. This is because the water is molecularly bound inside the fiber. Water is essentially part of the molecular structure.

Another issue that has been raised is the ability of nylon to attract and hold on to odors. The ability of nylon to absorb aqueous based odors is poor due to its inability to absorb

water. As stated above nylon is frequently chosen as a fiber to transport moisture, and odors along with it, away from the body.

How does hygroscopy affect the properties of nylon? Under use conditions the effect on nylon is minimal. Nylon can withstand much higher temperatures than polyethylene. The breaking strength, abrasion resistance durability and resilience of nylon are superior to polyethylene independent of at any temperature or humidity. Only at high temperatures is the effect of hygroscopy seen. Even then the performance characteristics of nylon are superior.



Encyclopedia of Polymer Science, Olefin Fibers
Man Made Fibers and their Properties

Nylon is an excellent choice for synthetic turf especially when strength, abrasion resistance, resilience and durability are required.

Davis Lee, Ph.D.

Founder and President
InnovaNet Technology Group