

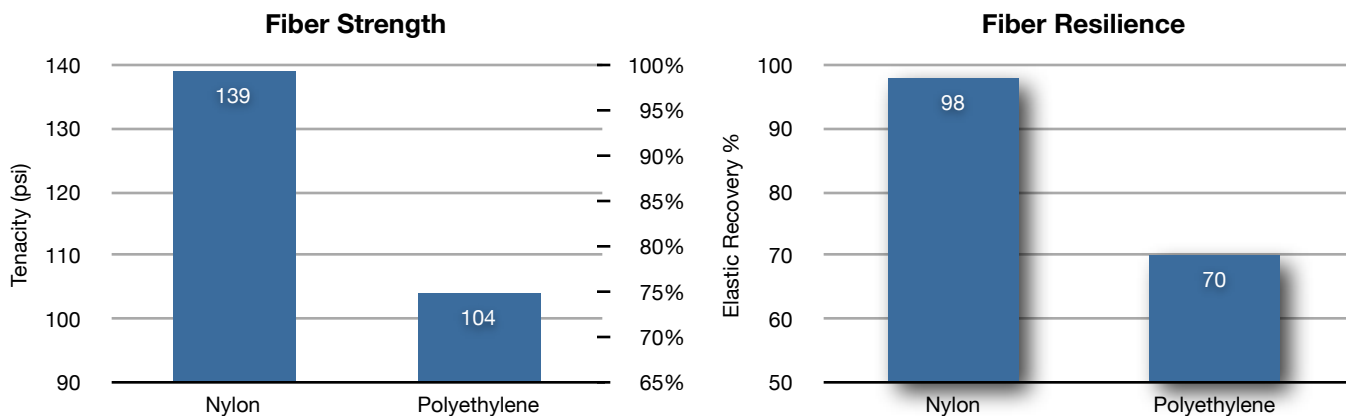
Nylon or Polypropylene in Synthetic Turf

Recently there have been questions about the merits of nylon and polypropylene in synthetic turf. Polyethylene is the predominant polymer used for synthetic turf. But nylon and polypropylene are often used. Questions about the performance and durability of these have been raised.

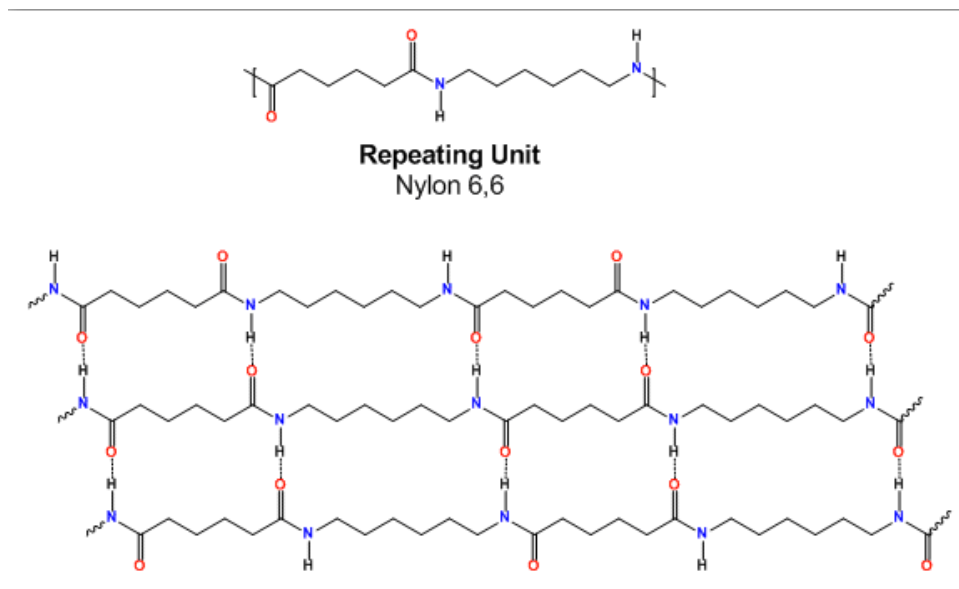
Interestingly nylon was the first turf fiber used to manufacture artificial turf. Chemstrand, a division of Monsanto, selected nylon because of its outstanding durability and performance characteristics. It was Chemstrand that designed and built the first synthetic turf installation. It was installed in the Astrodome in 1965. Of course synthetic turf has evolved considerably since that time. Now the fields which are much safer and easier to play on.

Nylon was a natural choice for Chemstrand since Monsanto produced nylon and nylon was extensively used as the principal fiber for carpet. In fact 80-82% of commercial carpet is currently made from nylon. 8-10% is made from polypropylene. The remaining 8% is wool. Why is nylon the dominate fiber in commercial carpet?

According to the Carpet and Rug Institute (CRI) “nylon is by far the most prevalent fiber used in commercial carpets. Nylon is excellent in wearability, abrasion resistance and resilience. Resilience is the ability of the fiber to spring back. Because of this nylon fibers withstand the weight and movement of furniture and are generally good for all traffic areas.”



What is it about nylon that makes it more wearable, abrasion resistant and resilient? The answer is in the basic chemistry of nylon. Shown in the graphic below, nylon is made of carbon, hydrogen, nitrogen and oxygen. The long molecules form a



symmetrical repeating structure that is capable of forming hydrogen bonds. This enables bonding between hydrogens and oxygens of adjacent polymer chains thus creating an enhanced internal strength. This phenomenon enables polymer molecules to weakly bond together creating a high degree of fiber strength and resilience.

This inherent internal strength is why nylon is extensively used in demanding applications. Ballistic fabrics, seat belts, weed trimmer line, fishing line and parachute cloth regularly use the same nylon polymer that is used in synthetic turf. Interestingly nylon is also used in women's hosiery and intimate apparel, applications not usually associated with high strength.

What is the difference between nylon and polypropylene? The CRI says this:¹

“Nylon continues to hold over half the carpet market. Nylon, a polyamide polymer, has excellent resilience (the ability of a fiber to “spring back” to its original configuration), abrasion resistance, mildew resistance, and very good color retention. It can be acid dyed or solution dyed, which is discussed later. On the downside, it is melted by very strong acids such as hydrochloric acid toilet bowl cleaners, is easily stained by acid dyes (the dyes in most foods and drinks), and is bleached out by chlorine bleach. Nylon comes in two forms: Type 6,6 and Type 6.

Polypropylene (olefin), a by-product of gasoline refining, continues to gain market share for two reasons: it costs significantly less than nylon and it is inherently stain resistant. Its inherent stain resistance arises from its lack of dye sites and the fact that it is chemically inert. Olefin's biggest drawbacks are its lack of resilience, its strong attraction for oily soils, and its propensity to wick more than nylon resulting in more frequent complaints of “reappearing spots”, streaking,

¹ CRI website

yellowing, and resoiling. Also, because it has a much lower melting point than nylon, friction from moving furniture or casters can permanently damage the fibers.”

For synthetic turf strength, resilience and abrasion resistance are key performance characteristics. UV resistance is also important but here nylon and polypropylene are similar and they both require stabilizers in order to insure optimum outdoor performance.

Fiber Characteristics

	Nylon	Polypropylene
Strength	Excellent	Good
Resilience	Excellent	Poor
Chemical Resistance	Good	Excellent
UV Resistance (stabilized)	Excellent	Excellent
Abrasion Resistance	Excellent	Poor
Color Retention (Pigmented)	Excellent	Excellent
Cost	Medium	Low
Propensity for Dye Staining* (Wine, Coffee)	Poor	Excellent
Propensity for Oil Staining* (Motor oil, Machine Oil)	Excellent	Poor
Microbial Resistance	Excellent	Excellent
Resistance to Water	Excellent	Excellent
* The green color in most synthetic turf does an excellent job of hiding stains associated with dye or oil.		

Polypropylene is less expensive than nylon because it is less expensive to produce. This fact alone will often encourage manufacturers to select polypropylene over nylon.

Otherwise nylon is a superior choice. It is more durable, stronger and more resilient. Some infer from this that nylon is harsh. But harshness or stiffness is related more to the dimensions and size of an individual fiber than to the fiber polymer. As a case in point intimate apparel is frequently constructed of nylon to take advantage of its strength. Needless to say, a harsh or stiff fiber would not be tolerated in this end use.

There is also some confusion about lead in turf. This was an issue in 2007 when it was discovered that synthetic turf contained lead and was addressed by the industry during 2008 and 2009. Neither nylon or polypropylene contain inherent lead. The lead that was an issue in 2007 was associated with pigment used to color the turf and was found in all turf polymers. As a result of the industry's response to remove this pigment all turf manufactured in the US is now well below the acceptable limits of lead.

Nylon is an excellent choice for quality focused synthetic turf products for many sound technical reasons. If economics are the primary driver, polypropylene fibers will provide a lower caliber, but cost effective alternative.