

Physical and Chemical Properties of Nylon

Nylon was the first man made organic textile fibre made from the raw materials from the mineral kingdom. It is a manufactured fibre in which the fibre forming substance is long chain, synthetic polyamide having recurring amide groups (-CO-NH-) as an integral part of the molecular chain.

Physical Properties

- Tenacity: 4-9 gm/den (dry), in wet 90% of dry.
- Elasticity: Breaking extension is 20-40%.
- Stiffness: 20-40 gm/den.
- Moisture regain: 3.5-5%; (not absorbent due to crystallinity).
- Specific gravity: 1.14.
- Abrasion resistance: Excellent.
- Dimensional stability: Good.
- Resiliency: Excellent.
- Softening point: Nylon 6,6 – 229°C, Nylon 6 – 149°C.
- Melting point: Nylon 6,6 – 252°C, Nylon 6 – 215°C.
- Hand feel: Soft and smooth.

Chemical Properties

- **Acid:** Nylon 6,6 is attacked by mineral acids is disintegrated or dissolved almost. But is inert to dilute acetate acid and formic acids even of the boil. It is dissolved in the concentrated formic acid. Nylon 6 is attacked by mineral acid but resistant to dilute boiling organic acid.
- **Bleaches:** Not attacked by oxidizing and reducing bleaches but may be harmed by chlorine and strong oxidizing bleaches.
- **Alkali:** Nylon is substantially inert to alkalis.
- **Organic solvent:** Most of the solvent have little or no effect on nylon. Phenol metacressol and formic acid dissolve the fibre but solvents used in stain removal and dry cleaning do not damage it.
- **Light:** No discoloration. Nylon 6 gradually loss of strength on prolonged extension.
- **Biological:** Neither micro organism nor moth, larvae attack nylon.
- **Electrical:** High insulating properties leads to static charges on the fibre.
- **Flammability:** Burns slowly.

Uses of Nylon

Apparel use

High tenacity nylons are used for parachute fabrics, cords and ropes. Having good dimensional stability, are used for ladies gloves, ladies hose, under wear, swimming wear, stocking, hosiery fabric etc.

Domestic use

It is used for home furnishing, in carpets, in upholstery and in ropes and cords.

Industrial use

In finishing nets, tire cords, filtering cloths, sewing threads, tow ropes are made of Nylon. It is used in manufacturing of belts of various machines (Flat belt, V-belts).

Molecular structure of nylon

Two of the ingredients that are used to synthesize the most common **nylon**, adipic acid and hexamethylenediamine, each contain six carbon atoms, and the product has been named **nylon-6,6**. When caprolactam is the starting material, **nylon-6** is obtained, so named because it has six carbon atoms in the **basic** unit.

Physical and Chemical Properties of Rayon Fibre

Rayon is a manufactured regenerated cellulosic fibre. Because it is produced from naturally occurring polymers, it is neither a truly synthetic fibre nor a natural fiber; it is a semi-synthetic fibre. It is known by the names viscose rayon and art silk in the textile industry. It usually has a high lusture quality giving it a bright shine.

Physical Properties

- **Strength:** It has varying strengths. Regular rayon loses some of its strength when wet. The highly wet molecules of rayon's are strong.
- **Absorbance:** Absorbency relies on inner structure of regenerated, cellulose, which is highly amorphous. It can be penetrated readily by water and other aqueous solutions. Due to its absorbency it can be readily dyed and it absorbs perspiration easily. As

water enters the fibre, it makes the hydrogen bonds between the molecular chains, pushes them apart and causes the fibre to swell. In this swollen state the fibres are weaker. Garments made of rayon shrink easily and cloths dry steadily.

- **Resiliency:** It has low resiliency due to the weak hydrogen bonds. Fabrics wrinkle easily unless given a resin finish.
- **Thermo Chemical:** Same as that of cotton. If temperature is too high it scorches and then burns.
- **Density:** Same as that of cellulose.
- **Conductivity:** It is enough to prevent the buildup of static electric charges.

Chemical Properties

- **Effect of alkali:** Strong alkali causes this fibre to swell and loose strength. Weak alkalis do not destroy.
- **Effect of Acids:** Hot and concentrated acids cause this fibre to disintegrate.
- **Miscellaneous:** Ultra-violet rays of sun deteriorate this fibre. They are resistant to all insects barring silver fish. Mildew destroys this fibre

Molecular structure of Rayon

It contains the chemical elements carbon, hydrogen and oxygen. **Rayon** fiber is a manufactured fiber composed of 100% regenerated cellulose, or regenerated cellulose in which **chemical** substituents have replaced not more than 15% of the hydrogens of the hydroxyl groups. **Rayon** fiber is soft, comfortable and versatile.

Uses of Rayon

1. Industrial Uses:

In most industrial uses, the durability of a fabric under moderate to severe treatment is a matter of prime importance in its selection. Rayon being relatively more expensive and much less durable than cotton in most such cases, has found little application in the field of industrial uses. With regard to cotton, rayon is

pertinent to mention here that industrial uses account for approximately two-fifths of the cotton consumed in the United States each year.

2. Used in Garments:

The fabrics used for the girls vests and boys two button union suits for these tests were all made on spring needle circular knitting machines. For each particular size of garments the cotton and rayon fabrics were both knitted on the same machine. The cotton fabric was knitted from combed yarn. The viscose rayon yarn, which was obtained from one of the larger domestic producers, was reported to have been made from a mixture of approximately 50 percent each of wood pulp and of purified cotton linters.