

## Effect on Tensile Strength of Nylon-6 by Adding Filler

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**Abstract** - A Polymer matrix composites are designed to improve the properties and reduce the cost of plastic engineering. In this study the effect of adding mica on the tensile strength of nylon6 was investigated (according to ASTM D63). Composite of nylon6 with adding (10 % weight) of mica were prepared by binder. The composite improves the tensile strength on addition of filler. In present paper work to increase the tensile strength, Nylon 6- Mica based composite has been prepared. After that as per tensile strength standard ASTM638 Component was made with transfer moulding. After making components tensile strength of components has been checked using Universal Testing Machine.

**Key Words:** Polymer matrix composite, compounding, mica, Transfer moulding, ASTM D638, Tensile strength.

### 1. INTRODUCTION

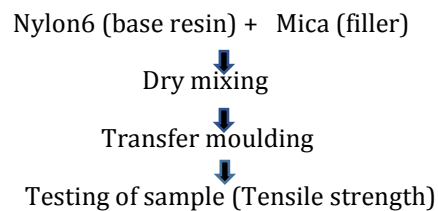
Polymer matrix composites have become attractive because of their wide application and low cost. Incorporating inorganic mineral fillers into plastic resin improve various physical properties of the material such as mechanical strength, modulus and heat deflection temperature. In general the mechanical properties of polymer matrix composite depend on shape, size and distribution of filler particles in the polymer.

Nylon6 are the most widely used engineering thermoplastic in automobile, packaging, electronic, electrical and textile application because of excellent mechanical properties. Hence numerous efforts have been taken to use nylons as matrix resins in composites by adding fillers such as Iron, Al<sub>2</sub>O<sub>3</sub>, and TiO<sub>2</sub> etc. In this investigation, mica was added to nylon-6 and check the behavior of addition of these fillers on the tensile strength were examined by ASTM D638.

### 2. EXPERIMENTAL

#### 2.1 Experimental Plan

The presentation of experimental plan is shown in the following figure:



#### 2.2 Material selection

Nylon6 (325mesh) was selected as a binder material. Nylon6 has medium melt viscosity and is most widely used for producing strapping, zippers, monofilaments, cords, and profiles. It is semi-crystalline engineering thermoplastic having good abrasion resistance, sliding properties, very tough, rigid, and electrically insulated, chemical resistance to many oils, greases, diesel, petrol, cleaning fluids, and can be easily welded, machined, and bonded. The important processing properties of Nylon6 are listed in Table 1.

**Table -1:** properties of nylon6 powder

Sr.no	Properties	Value
1	Melting point(°C)	250
2	Melt index 240/2,16	10
3	Density (g/cm)	1.13
4	Tensile strength (kg/cm <sup>2</sup> )	200-400

In this work, pure micas act as filler materials. It provides smooth consistency and improves the workability of the compound. Moreover, it has outstanding properties, such as lightweight, dielectric, flexible, resilient, reflective and insulating. The important processing properties of mica are listed in Table 2.

**Table -2:** properties of filler

Sr.no	Properties	Value
1	Melting point(°C)	700-1000
2	Hardness (Mohs' scale)	3-3.5
3	Specific gravity	2.8-3.0
4	Tensile strength (kg/cm <sup>2</sup> )	1750
5	Dielectric strength at 20°C(V/mil)	3000-6000

### 2.3 Compounding

Take the sample of composite (Fig.1) and add filler (10% of nylon6). The nylon6 and filler were dried for 1 to 2 hours then weigh the base resin and filler as per composition. Put the nylon6 and filler in blender with set temperature and parameter as 18°C and 50 rpm respectively. After 30min of blending check the distribution of filler in powder.



Fig.1 Composition of nylon6 and filler

### 2.4 Transfer moulding

A moulding polymer is pressed into a preheated mould and taking a shape of the mould cavity. This method is mostly used for moulding thermosets, but some thermoplastics may be produced by compression moulding. Silicon spray is used to make the surface non-stick. Heat the mould for 10 minutes at 380°C to clean the mould. After that assemble the mould (Fig.2) and check for tightness, then the resin is fully filled in the mould and heated at 250 °C.



Fig.2 Mould

After 1.5 hours take the hot mould and check if nylon6 is purely melted or not from upper side in the runner pot. Place piston above runner pot and fit mould on press (5 ton to 50 ton) at zero pressure. If nylon6 overflows from holes then

spray water on the holes. Hold the same zero pressure and cool for 2 minutes. After air cooling, cool the bottom plate by water spray for 2 min, cool the upper side of mould by water spray for 2min, cool the assembly by water for 10min, then disassemble the mould and eject the unwanted part of the mould.

### 2.5 Tensile strength

Polymers are found in different variety of items used on daily basis. Nowadays, polymer composites are used in automobile and aircraft industry due to their strength. In these applications, it is important to understand the mechanical strength of this polymer composite. ASTM D638 is specified method for testing the tensile strength of specimen.



Fig.3 Specimen for testing

### 3. Result

Tensile strength of nylon6 powder is shown in Fig.4.

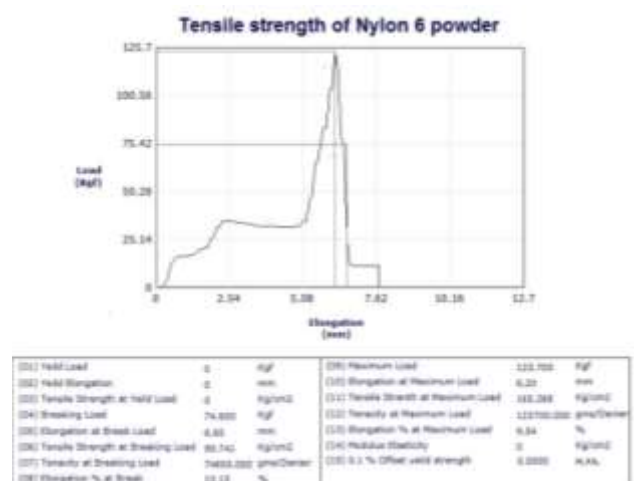


Fig.4 Tensile strength of nylon6 powder

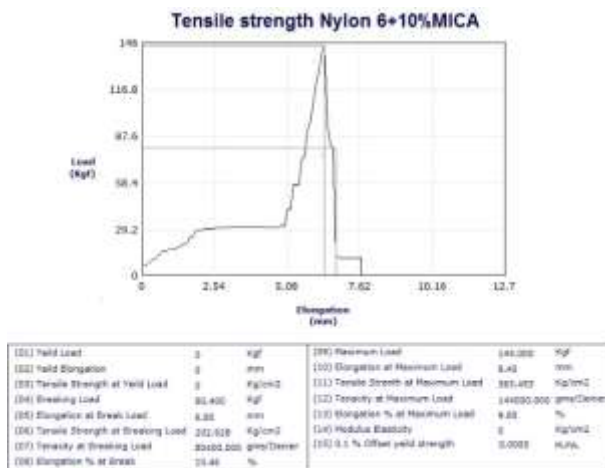


Fig.5 Tensile strength of nylon6+10% mica

Tensile strength of powder is 165.388kgf/cm<sup>2</sup> and tensile strength of nylon 6 with adding (10% weight) mica is shown in Fig.5 Then the tensile strength increases to 363.453kgf/cm<sup>2</sup>. There was a significant increment in the strength after adding the filler. But the tensile strength of nylon powder is not exactly as supplier specified because of variation of processing parameter.

#### 4. Conclusion

The research done states that tensile strength of nylon6 increases by adding mica filler. So, we can use this composite in automobile industries to increase strength, especially in automobile parts such as lightweight insulation to suppress sound and vibration.

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