

# Studies on wollastonite reinforced recycled ABS (Acrylonitrile butadiene styrene) composites

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**Abstract** – Wollastonite is one of the inorganic fillers. wollastonite reinforced recycled ABS (Acrylonitrile butadiene styrene) composites were studied. Powder-based wollastonite with a particle size of 13 microns was mixed with recycled Acrylonitrile butadiene styrene in various proportions of wt.%. Twin-screw extruder is used for compounding. Mechanical properties like Flexural strength and flexural modulus as per ASTM D790 was carried out and the results were compared with recycled ABS. It was found that the recycled ABS with 10%,20%,30%,40% of wollastonite has improved the Flexural modulus and as well as fall in flexural strength.

**Key Words:** Calcium silicate, flexural properties, recycled ABS, Wollastonite, composites, injection moulding, plastic waste management.

## INTRODUCTION

The addition of inorganic fillers is an effective method to improve the physical and mechanical properties of polymer materials [1]. Some research works indicate that wollastonite is an effective and low-cost filler that can improve the tensile modulus, stiffness, hardness and strength of polymers [2]. It's time to rethink the way we manufacture, use and dispose of plastic items in the most favourable way. Recycling is very important as waste has a huge negative impact on the natural environment. Acrylonitrile-butadiene-styrene (ABS) was selected as the feedstock. It is a sought-after polymer due to its high impact resistance, resistance to chemicals and strength properties, it is useful in manufacturing a wide range of products like electrical devices, luggage cases, keyboards, television cases, refrigerator housing, grinder, mixer, washing machines, furniture's, building materials etc. Similarly, the waste which is generated from those resources is commendable. These wastes are recycled and reused [3]. The aim of the investigation is to evaluate the effectiveness of the wollastonite on recycled ABS. The composites of recycled ABS and wollastonite with various weight proportions were compounded using a twin-screw extruder and studies on the flexural property was carried out. Those results were compared with the properties of recycled ABS and virgin ABS. wollastonite reinforced 10%, 20%, 30%,40% with

recycled ABS showed an increase in flexural modulus it shows rigidity/stiffness is increased as well as fall in flexural strength.

## MATERIALS AND TEST DETAILS:

**Material:** Virgin ABS (Acrylonitrile butadiene styrene) and Recycled ABS Injection Grade

**Filler:** Wollastonite (CaSiO<sub>3</sub>) in the form of powder. The particle size of Wollastonite is 13.83 microns. Which was having 86.50% brightness compared with 100% MgO, Bulk density of 0.91 g/cc and chemical composition (CaSiO<sub>3</sub>) as Cao+Sio<sub>2</sub> 92.78%.

**Preparation of composite:** Compounded using twin-screw extruder[3].

## Sample Code Details:

S.NO	Sample description	Sample Code No
1	Virgin ABS	A
2	Recycled ABS	B
3	Recycled ABS+10% wollastonite	C
4	Recycled ABS+20% wollastonite	D
5	Recycled ABS+30% wollastonite	E
6	Recycled ABS+40% wollastonite	F

**Preparation test specimens:** Test specimens were prepared using Injection moulding. ABS material is hygroscopic so it was properly pre-dried at 120°C for 2 hours and then it was moulded.

**Test Details:** Studies on mechanical properties such as flexural strength and flexural modulus was carried out.

## Experiment:

**Flexural properties:** The flexural strength and flexural modulus were carried out as per the ASTM D790 three-point bending.

Equipment name: UTM

Specimen size: Rectangular specimen Length 127mm width 12.7mm thickness 3.0 mm

Rate of strain 1.6 mm/min.

Span length 48mm

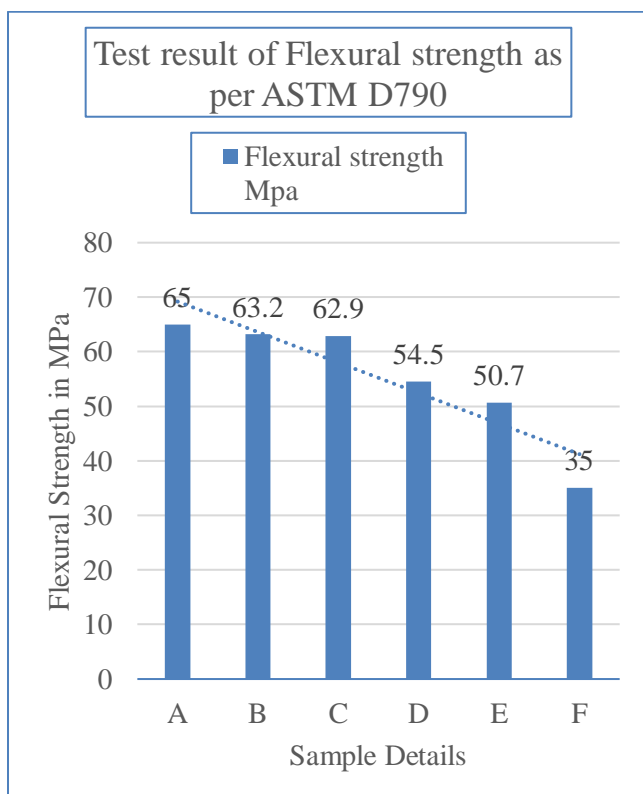
No of specimens 5

**Experiment results:** 10% to 40% of wollastonite filler with recycled ABS shows good improvement in flexural modulus. compared virgin and recycled ABS. proportions. Flexural strength gradually decreased after adding wollastonite Flexural properties test result details are mentioned in Table 1,2 Chart 1,2.

**Table 1**

The test result of flexural properties as per ASTM D790			
S.NO	Sample description	Sample Code No	Flexural strength Mpa
1	Virgin ABS	A	65
2	Recycled ABS	B	63.2
3	Recycled ABS+10% wollastonite	C	62.9
4	Recycled ABS+20% wollastonite	D	54.5
5	Recycled ABS+30% wollastonite	E	50.7
6	Recycled ABS+40% wollastonite	F	35

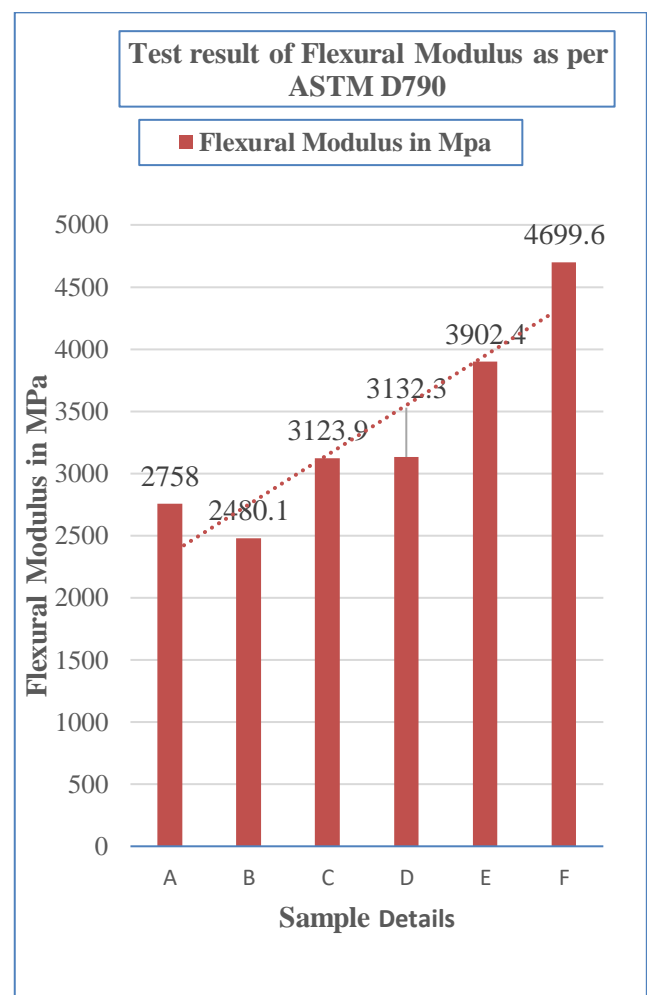
**Graph 1**



**Table 2**

The test result of flexural properties as per ASTM D790			
S.NO	Sample description	Sample Code No	Flexural Modulus in Mpa
1	Virgin ABS	A	2758
2	Recycled ABS	B	2480.1
3	Recycled ABS+10% wollastonite	C	3123.9
4	Recycled ABS+20% wollastonite	D	3132.3
5	Recycled ABS+30% wollastonite	E	3902.4
6	Recycled ABS+40% wollastonite	F	4699.6

**Graph 2**



## DISCUSSION:

Flexural strength gradually decreased with the increment of filler. Flexural modulus is gradually increased after adding various weight percentages (10%,20%,30%,40%) with recycled ABS. For 10%,20% it has given 25.9% increment in flexural modulus, for 30% it has given 57.3% increment and for 40% it has given 89.5% increment in flexural modulus. At the same time, it has been observed that compared to virgin ABS material it has given a 70.4% increment in flexural modulus with 40% of wollastonite filler with recycled ABS. So wollastonite can be added with virgin ABS also. So that the flexural modulus also will be improved effectively.

## 3. CONCLUSIONS

The test result shows wollastonite filler might have the ability to impart greater stiffness to the composites. There is an improvement in flexural modulus by 45% with 40% of wollastonite as well as a fall in flexural strength. Which indicates an increase in the rigidity of the polymer. From all the above it can be concluded that the use of wollastonite as a filler for recycled ABS is possible only to lower the cost and impart rigidity. It can be significantly used in the places where virgin ABS is used.

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