Preparation and Characterization of ABS /CPVC/SHORT GLASS FIBER composites: Cop's sleeve for textiles industries

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ABSTRACT

ABS/ SGF (short glass fiber) composites have a broad range of applications likes household appliances, automobiles, and textile industries as cops' sleeve. ABS (Acrylonitrile butadiene styrene) is a terpolymer having good structural stability and processibility. The reinforcement by SGF makes this material structurally stable and provide the better abrasive wear properties for strong grip of yarn. When ABS /SGF is used as cops sleeve it pulls out (elongation) from original shape and cracks occur on sleeve in 20-25 days, due to compressive force of wound yarn.

To enhance the compressive strength and dimension stability ABS and SGF were melt blended with CPVC in twin screw exruder.The various ABS//CPVC/SGF composites material were prepared by composition of 5,10 and 15 weight percent CPVC in ABS/CPVC/SGF. The specimen was prepared by the injection molding process. The composites having different ratio of CPVC content were tested to determine tensile, flexural, impact strength hardness and also test SEM.The invention relates to enhance the compressive strength and dimension stability of ABS /SGF composites cop's sleeve.

Keywords: *Acrylonitrile Butadiene Styrene, Chlorinated Polyvinyl Chloride, Scanning Electron Microscope Short Glass Fiber*

1. INTRODUCTION

ABS is a terploymer having good structural stability and processibility. It is a made by polymerizing process of styrene, acrylonitrile and polybutadiene.[1] The high toughness values, dimensional stability, and good surface texture of acrylonitrile-butadiene-styrene (ABS) make it an important material for industrial applications {2-3}.Short Glass fiber is reinforcement material, it is added to plastics when to improve their mechanical properties. The reinforcement by SGF makes this material stable and provide the better abrasive wear properties for strong grip of yarn. Chlorinated polyvinyl chloride (CPVC) is a thermoplastic produced by chlorination of polyvinyl chloride (PVC) resin. CPVC has excellent compressive strength properties.

This research related to improve the compressive strength and dimension stability of ABS/SGF fiber. More important, this invention relates to incorporation of CPVC with ABS and SGF for improve their mechanical properties. In this work we aimed to produce composites of ABS/CPVC/SGF with varies range from 5%, 10%,and 15% of CPVC composition and study about their effect on mechanical properties.

2. MATERIAL AND EXPREIMENTAL PROCEDURES

2.1MATERIALS:

ABS material was procured from bhanshali engineering poly. Ltd, CPVC was purchased from flowkem pvt ltd, and SGF was procured from Ekta Enterprises, Faridabad of 3mm Size.

Table -1 source of ABS resin and CPVC

ACRYLONITRILE BUTADIENE STYRENE (ABS)	CHLORINATED POLYVINYL CHLORIDE (CPVC)
Source:- bhansali engineering polymer ltd. Abu road, Rajasthan	Source:- flowkem poly plast Pvt. Ltd
Grade:- (Abstron,Bhansali),Grade- PT 45M	Grade:- LUCALOR RH1167S

2.2 METHODOLY

2.2.1 Salinization of Short Glass Fiber:

Short glass fiber was treated with 3-aminopropyltriethooxy Silane, coupling agent to improve bond strength between polymer and short glass fiber.

2.2.2 Additives Were Added With CPVC:

The additives were added with CPVC in different ratio followed by high speed mixer (MAKE:MALIKSONS DELTA MACHINE- CRAFTHLC, CIPET Ahmedabad). The additives were added also based on the parts of hundreds of CPVC. These consist of 10 phr of methyl tin stabilizer, 1 phr of calcium stearate and 0.7 phr of stearic acid

2.2.3 Compouding

for compounding the material was predried at 70^0c for 3 hours. Four batches were prepared of different composition, The composition are given below. Co-rotating Twin screw extruder (Make: SPECIFIQ ENGINEERING & AUTOMETS Model ZV - 20 HI – TORQUE) was used for the preparation of CPVC, ABS and short glass fiber composites. The compounding were done in Processing Laboratory, HLC, CIPET- Ahmedabad. Considering the each batch size of 2.5 kg.

Table – composition

BATCH NO.	BATCH CODE	COMPOSITION
1.	Batch 1	ABS (80%) +CPVC (0%) +SGF (20%)
2.	Batch 2	ABS (75%) +CPVC (5%) +SGF (20%)
3.	Batch 3	ABS (70%) +CPVC (10%) +SGF (20%)
4.	Batch 4	ABS (65%) +CPVC (15%) +SGF (20%)

2.2.4 SPECIMEN PREPARATION

For the various tests, The test specimens were produced by using Injection Moulding Machine (Make : endura series 90) in OLC, CIPET Ahmedabad, Gujarat. To remove the moisture form the material, the material was predried for 4 hours at 70°C before loading the material in the hopper. The mounding process was carried out at 170-200°C and various test specimens were produced to carry out various tests.

3 RESULTS AND DISCUSSIONS:

3.1 Mechanical Properties:

3.1.1Tensile Strength:

The chart 1 shows the results of tensile test. With the increases the percentage of CPVC, the tensile strength of composite is increased.

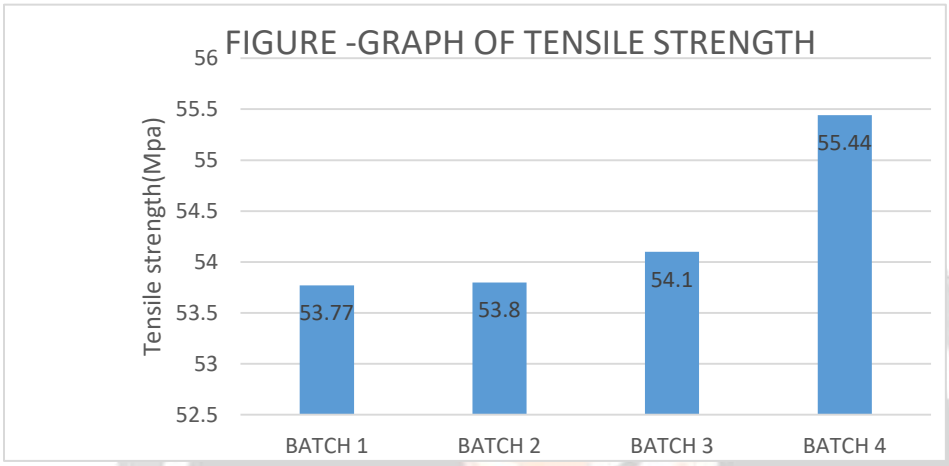

Chart 1- Tensile Strength v/s % of CPVC

3.1.2 Impact Strength

chart 2 shows the impact test result of composite. The Graph shows that impact strength of composites are slightly decreasing when increase the % of CPVC. It can observe that impact strength decrease due to increase the content of CPVC

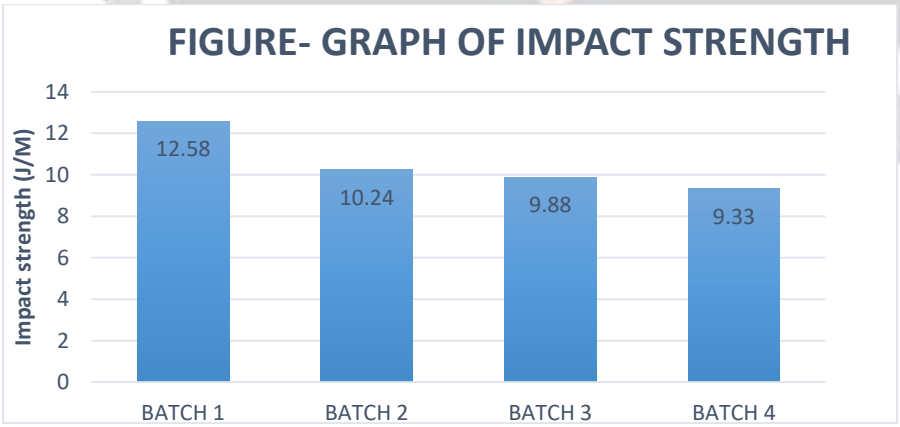

Chart 2 - Impact Strength v/s % of CPVC

3.1.3 FLEXURAL STRENGTH:

Graph represents the test results of flexural properties. It was seen that increase the % of CPVC then increase the flexural strength. It can show that flexural strength increase due to better bonding strength between polymer and short glass by coupling agent.

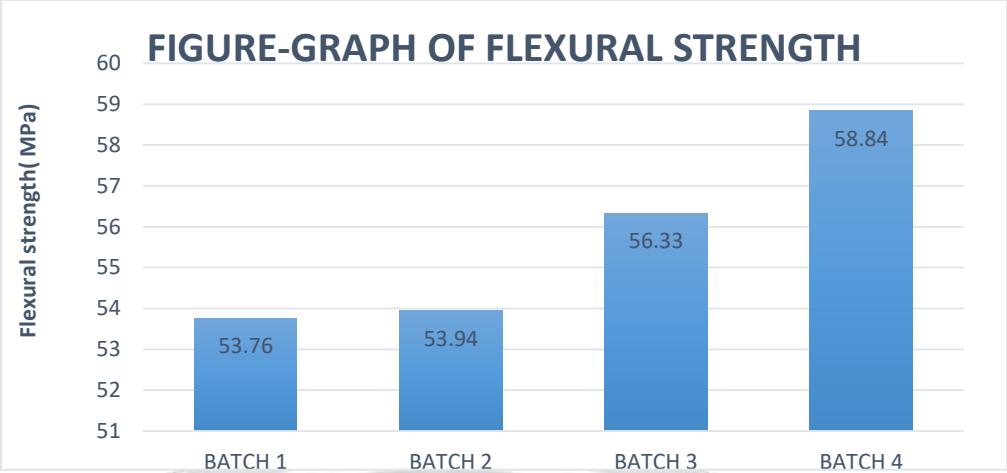

Chart 2 - Impact Strength v/s % of CPVC

3.2 THERMAL PROPERTIES

3.2.1 HEAT DEFLECTION TEMPERATURE AND VICAT SOFTENING TEMPERATURE (HDT/VST)

Graph shows the effect of CPVC on HDT and VST with increase the % of CPVC. As the % of CPVC increased HDT and VST also slightly increase.

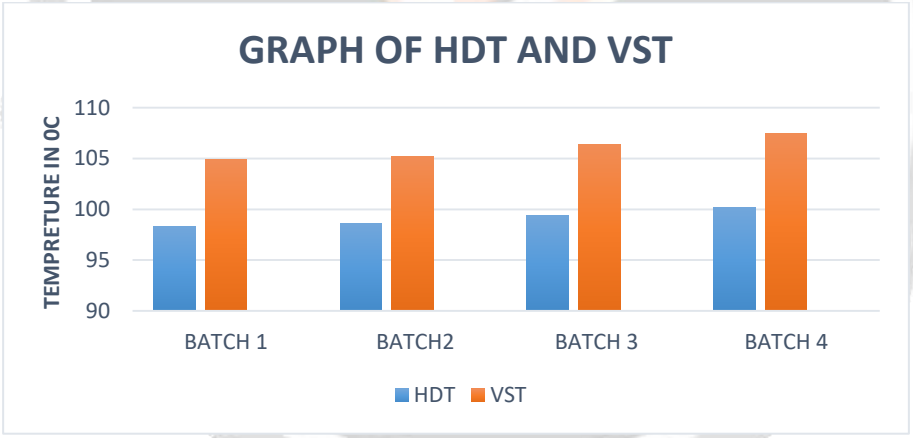

chart 4- Temperature v/s % of CPVC

3.3 MORPHOLOGICAL PROPERTIES
3.3.1 SEM (SCANNING ELECTRON MICROSCOPY)

By the help of SEM (scanning electron microscopy), we examined the morphology of composites.

The SEM results are shown below:

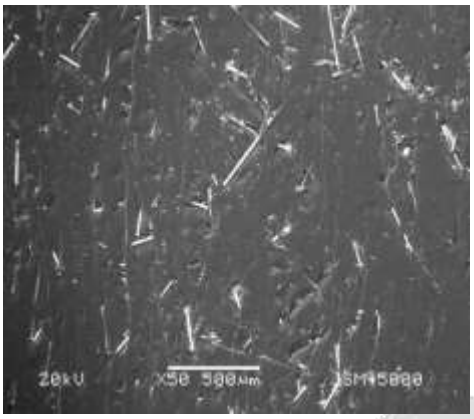

Fig – 4.3 (a)SEM Image of BATCH 1(0% CPVC)

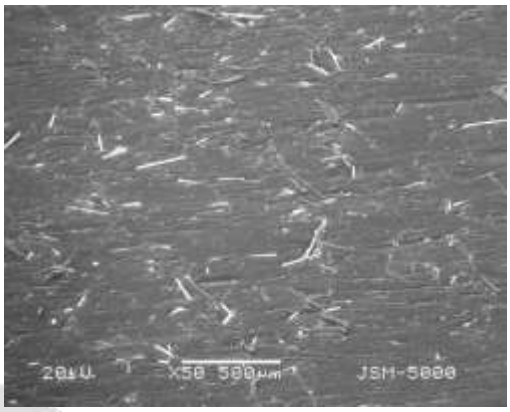

Fig4.3(b) - SEM Image of BATCH 2(5%CPVC)

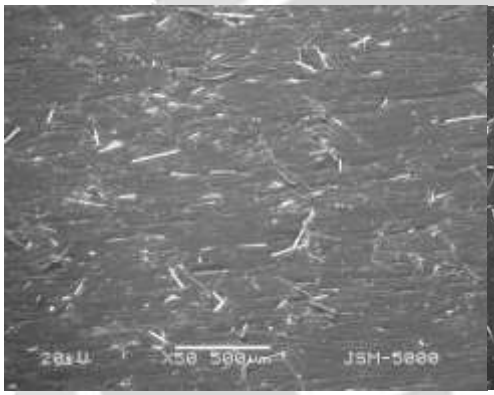

Fig4.3(c) - SEM Image of BATCH 3 (10% CPVC)

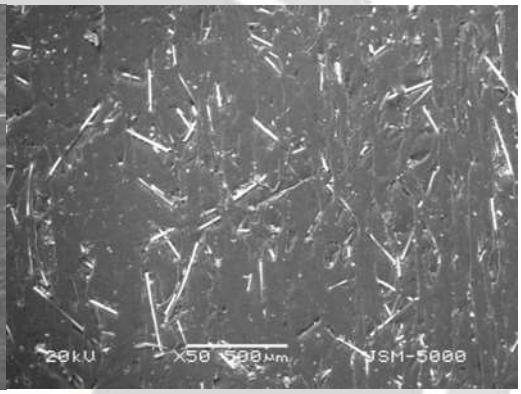

Fig 4.3(d)- SEM Image of BATCH 4{15% CPVC)

4 Conclusion

- The results that when CPVC concentration increases in ABS/SGF composites from 5 to 15 % then, tensile strength and compressive strength are improved. However impact strength was lowered. Flexural strength got increased due to stronger bond formation between polymer and short glass fiber. The stronger bond was produced due to the use of silane treated short glass fiber. The image of SEM test results shows the better dispersion and better interaction with short glass fiber and polyme

5. References

[1]Pak S.H and C.Caze (1997), Journal.appl. poly. Sci. vol65,pg 143

[2]. An Introduction to Composite Materials D. Hull (1987), Cambridge University Press, Cambridge, UK.
[3]. Composite Science Technology. Eberhardt C, Clarke A, Vincent M, Giroud T and Flouret S (2001), pg61
[4] Divakar H , Nataraja, R., S. Puttaswamaiah , Guruprasad, H. L. "*Mechanical Characterization of Thermoplastic ABS /Glass Fibre Reinforced Polymer Matrix Composites*" | IJERT (2015) | Vol. 4, 2278-0181.
[5]. Palaniappan R., Kanthabhabha J., Zijian Zhao and Abdel-Hakim Bouzid , "HDPE And PVC Creep And Thermal Ratcheting Behavior Under Compression"|21st International Conference on Composite Materials Xi'an| 2017.

[6]. Hassan,A., Abozar Akbari, and Ratnam C., "Mechanical and Thermal Properties of ABS/PVC Composites: Effect of Particles Size and Surface Treatment of Ground Calcium Carbonate" | Polymer-Plastics Technology and Engineering| 2012

[7]. Shokoohi , Arefazar, Ahmad, "Effect of Processing Conditions and Coupling Agents on ABS/SGF Composites Properties", journal reinforced plastics and composites| vol. 28| no. 9/2009.

[8]. Ozkoc, Bayram, Bayramli, "Short Glass Fiber Reinforced ABS and ABS/PA6 Composites: Processing and Characterization", Polymer Composites|2005