Effect of Ethylene Bis Stearamide (EBS) Lubricant on Glass Fiber, ABS and SAN

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ABSTRACT

Glass fibers (GF) are the reinforcement agent used in most of the thermoset and thermoplastic based composites, as they create a good balance between properties and cost. The mechanical properties of the thermoplastic polymer changes gradually and drastically by addition of layers of glass fiber.

The glass filled Acrylonitrile Butadiene Styrene (ABS) and Styrene Acrylonitrile (SAN) will suitable for home appliances and electrical parts applications. They show very high heat resistivity, dimensional stability and good thermal conductivity. The composite materials were produced by injection moulding process and compounding in side feeder Twin screw extruder of glass fiber, ABS resin and SAN melts were added by incorporating into the melt up to about 0 to 2 percent by weight of ethylene bis stearamide (EBS) lubricant. The specimens obtained from composite materials having different ratio of lubricant content were tested to determine tensile, flexural and impact strength, hardness, HDT/VST, MFR and also test FTIR. The EBS excellent lubricant for shear processing in melts of glass filled ABS and SAN. This invention relates to the improved shear processing and effect of mechanical property and thermal property of glass filled ABS and SAN melts.

Keywords: *Acrylonitrile Butadiene Styrene, Styrene Acrylonitrile, Glass fiber, Ethylene Bis Stearamide*

1. INTRODUCTION

Acrylonitrile Butadiene Styrene (ABS) is a terpolymer and an engineering thermoplastic which is made by polymerizing styrene and acrylonitrile in the presence of polybutadiene. Styrene Acrylonitrile (SAN) is a rigid, transparent plastic produced by the copolymerization of styrene and acrylonitrile. SAN combines the clarity and rigidity of Polystyrene with the hardness, strength and heat and solvent resistance of poly acrylonitrile [2]. Glass fiber-reinforced polymeric materials are widely used as structural materials in many engineering applications. Because they offer several advantages, such as ease of processing, the possibility of obtaining complex shapes, higher strength/density ratio, and recycling, short glass fiber (SGF)-reinforced thermoplastics are of great commercial and scientific interest [1]. It is known that some properties of plastics are improved by the incorporation of SGF with economical processing methods such as extrusion and injection molding. The properties of SGF-reinforced thermoplastics depend not only on the properties of the matrix and fiber, but also on the glass fiber content, orientation and aspect ratio of the fibers, distribution, and fiber/matrix adhesion [2,3].

This invention relates to the improved shear processing of acrylonitrile-butadine-styrene (ABS) and styrene-acrylonitrile copolymer (SAN) melts. More specifically, this invention relates to the incorporation of certain specific ethylene bis stearamide (EBS) lubricant into ABS resins and SAN resins for imposed melt forming operations. When EBS is incorporated as lubricant in the ABS resin which then is subjected to high temperature (which might exceed about 200°C such as 205°C or more). It will good compatibility applied in most plastics with function of lubricating, dispersing, demolding, smoothing, sticking resistance and antistatic. EBS is also low viscosity in molten form under high temperature, Excellent colour and colour stability and Increase the flow characteristics of ABS [4,5]. In this study we aimed to produce SGF reinforced ABS materials by extrusion to observe the effects of the SGF loading level on the mechanical and rheological properties.

2. MATERIALS AND EXPERIMENTAL PROCEDURES

2.1 MATERIALS

ABS resin and SAN (2380) was provided by INEOS Styrolution Ltd. and Glass fiber was procured from the Nippon Electric glass, with 2.6g/cc density with 3mm length and 13µm was taken to reinforce the ABS/SAN blend. For making the composite hard, heat resistant, strong and dimensionally stable.

Table -1: Sources of Glass Fiber and EBS Lubricant

GLASS FIBER	EBS LUBRICANT
Source :- Nippon Electric Glass Co. Ltd., Japan	Source :- Palmamide Sdn. Bhd., Malaysia
Grade :- ECS 03T - 351	Grade :- L104-MSDS-A005

2.2 METHADOLOGY

2.2.1 Pre Mixing:

Premixing of SAN(2380), ABS resin, Glass fiber (Nippon) and EBS lubricant in a ratio of 60%, 20% and 20% wt/wt respectively. Premixing was done in high speed mixer for 2 min at 2000 rpm.

2.2.2 Compounding:

Premixed material was predried at 90ºC for 4 hrs. Then granules prepared by Co-rotating Twin screw extruder (Make: SPECIFIC ENGINEERING & AUTOMETS Model ZV - 20 HI – TORQUE) was used for the preparation of SAN (2380), ABS resin and glass fiber. The composites were produced in Processing Laboratory, HLC, CIPET, Ahmedabad. Considering the batch size of 2 kg, for making composites the various compositions had been prepared. The composition is given below. Material was processed in the twin screw extruder with high shear and high intensity mixing using temperature range 200-230ºC. The material melted through a die and granulated after passing the strands through a cooling bath.

Table -2: Composition

BATCH NO.	BATCH CODE	COMPOSITION
1.	B1	Glass filled ABS and SAN + EBS 0.0 wt.%
2.	B2	Glass filled ABS and SAN + EBS 1.0 wt.%
3.	B3	Glass filled ABS and SAN + EBS 1.5 wt.%
4.	B4	Glass filled ABS and SAN + EBS 2.0 wt.%

2.2.3 MOULDING:

For the various tests, specimens were prepared by using Automatic Injection Moulding Machine (Make: Sigma 80) in INEOS Styrolution Ltd. In Vadodara, Gujarat. Before loading the material in the hopper the material is predried for 3 hrs. at 90°C to remove moisture. The injection moulding was carried out at 200-220°C and different test specimens were prepared to carry out various tests.

3. RESULTS AND DISCUSSIONS

3.1 MECHANICAL PROPERTIES

3.1.1 TENSILE STRENGTH:

Through the tensile property, we check the strength of the material. In this property we can check that the strength of material withstand the forces.

The result of the tensile strength of composite shown in figure 4.1. This shows the results of tensile test. With the increases in EBS content, the tensile strength of composite was decreased. It can be shown that tensile strength is decreased due to the adding of Glass fiber.

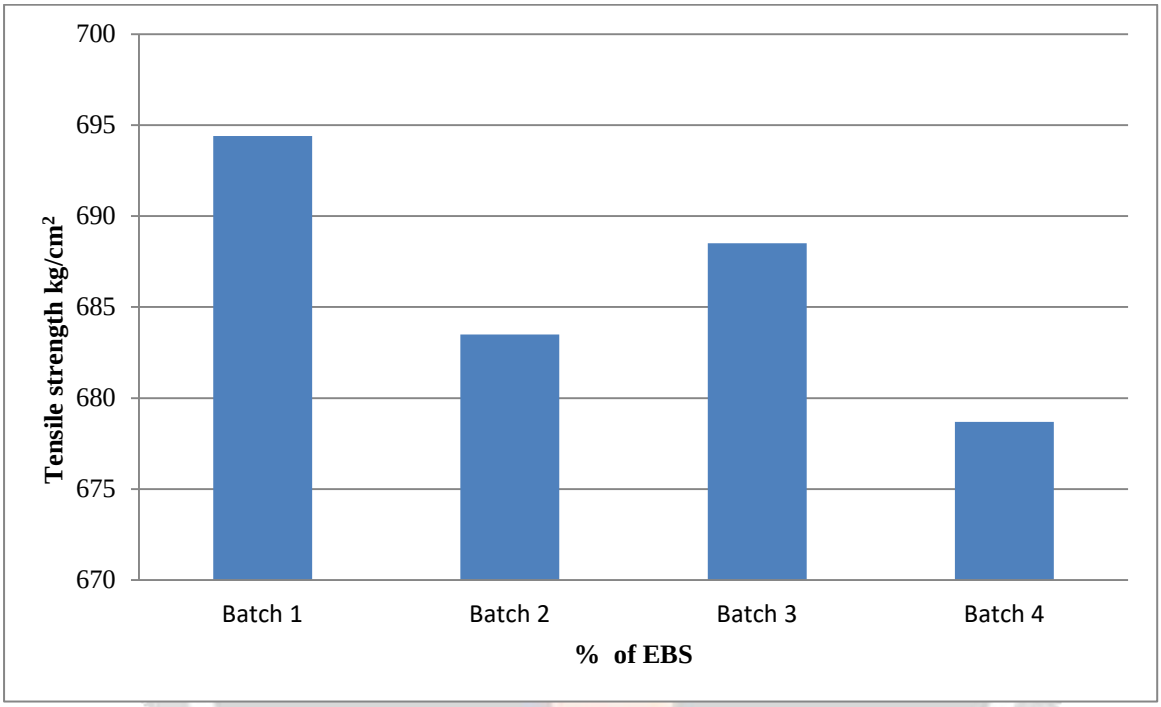

Chart -1: Tensile Strength vs % of EBS

3.1.2 IMPACT STRENGTH:

Impact strength is that mechanical property which check the capacity of the material to resist the fracture and absorb applied energy. It examines the toughness of the material.

It can shown in figure 4.2. In the graph we can seen that impact strength is decreased when adding a glass fiber in batch 1 and impact strength is slightly increases in batch 2. There is no significant effect in the batch 3 and batch 4. With the increases the content of EBS the impact strength were decreased.

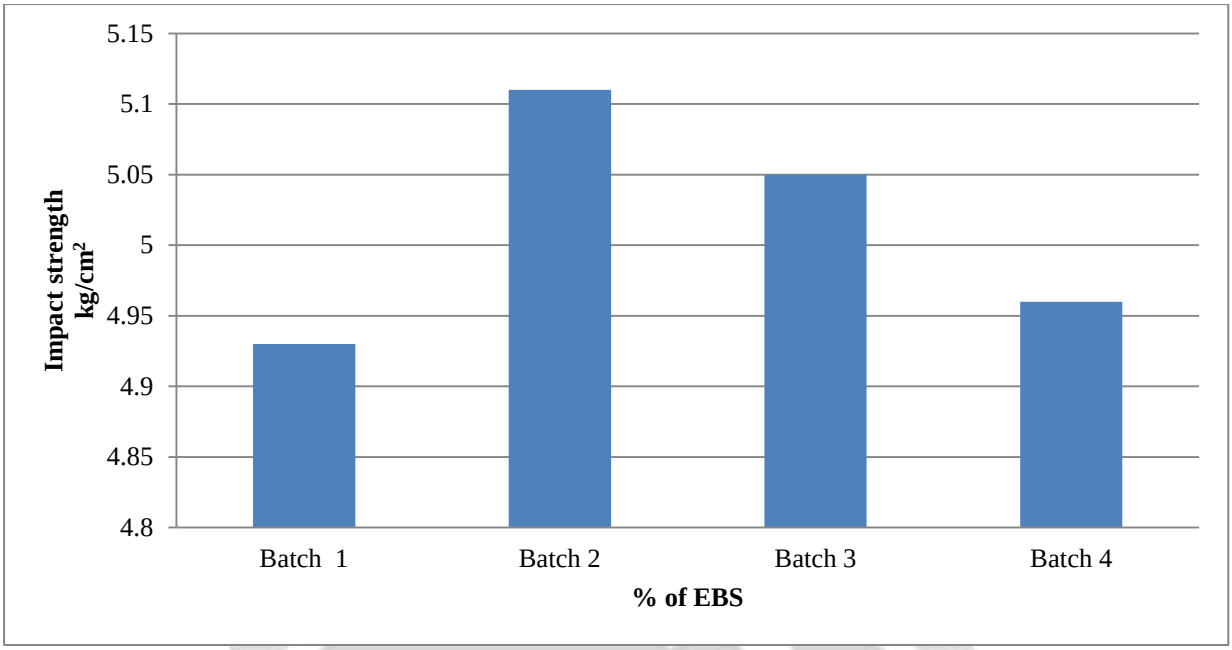

Chart -2: Impact Strength vs % of EBS

3.1.3 FLEXURAL MODULUS:

Chart -3 shows the effect of lubricant on ultimate flexural modulus with different % of EBS. It was observed that addition of up to 1.5 % EBS Flexural modulus was increased and at 2% of EBS flexural modulus was decreased. Hence, according to the result, EBS with 2% was not provided the significant effect.

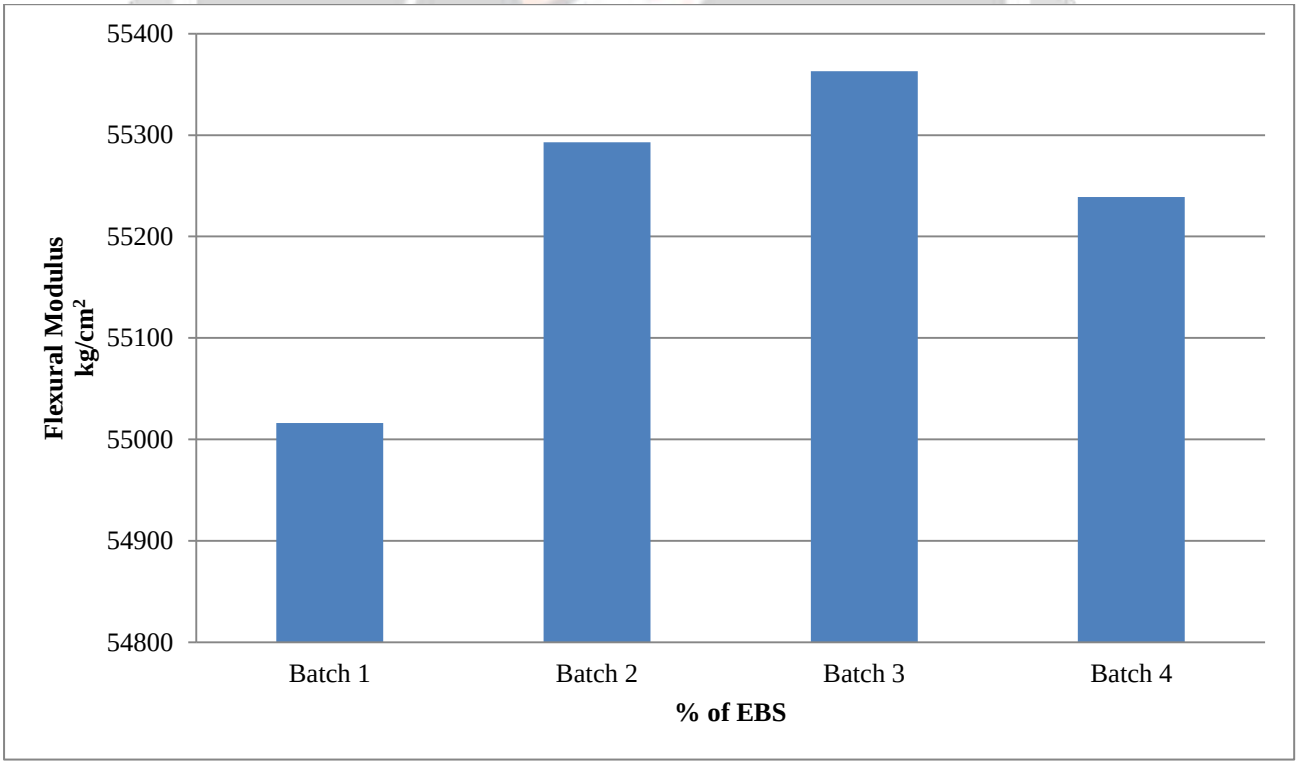

Chart -3: Flexural Modulus vs % of EBS

3.2 THERMAL PROPERTIES:

3.2.1 Heat Deflection Temperature and Vicat Softening Temperature:

Chart Shows the effect of lubricant on HDT and VST with increase the % of EBS. As the % of EBS increased HDT and VST also increase, this may be due to presence of glass fiber. It was observed that with the increasing of EBS % Thermal property also increased.

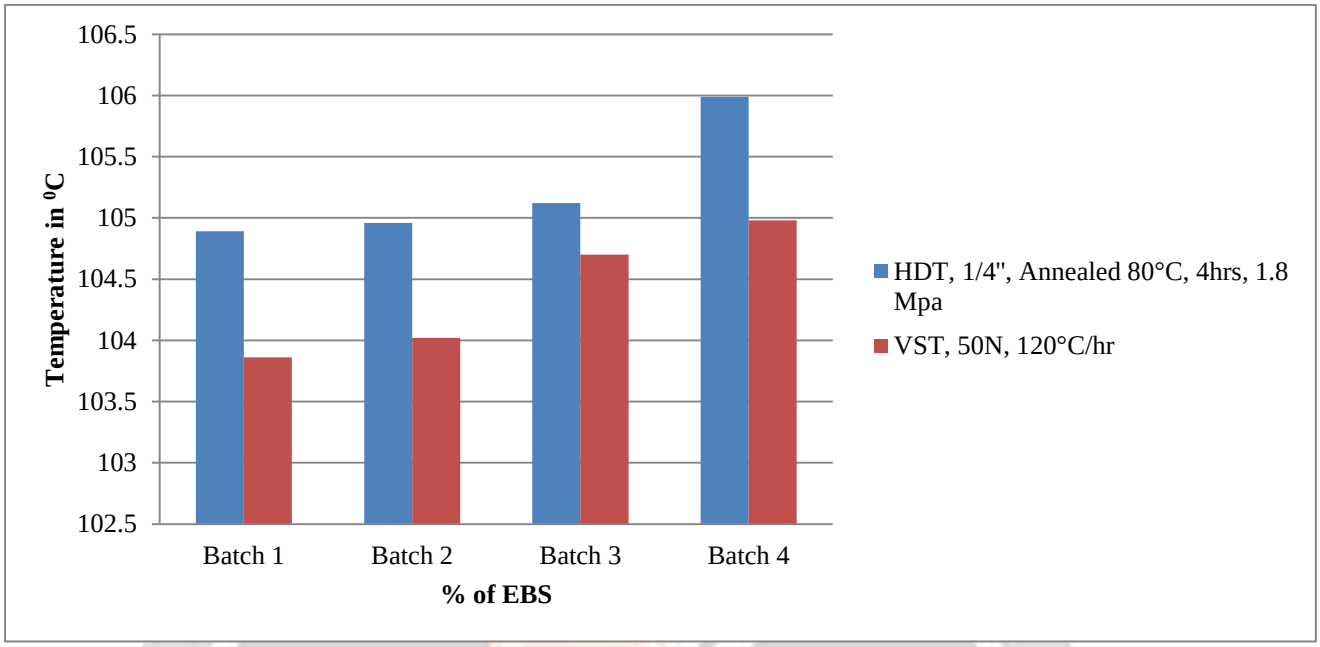

Chart -4: Temperature vs % of EBS

MELT FLOW RATE:

Melt flow rate was checked with the MFI Machine for four different batches. As per the chart Melt flow rate was increased with increasing in Lubricant (EBS) percentage. Chart of melt flow rate provide the information that addition of EBS lubricant improve the flow behaviour and decrease the viscosity of material.

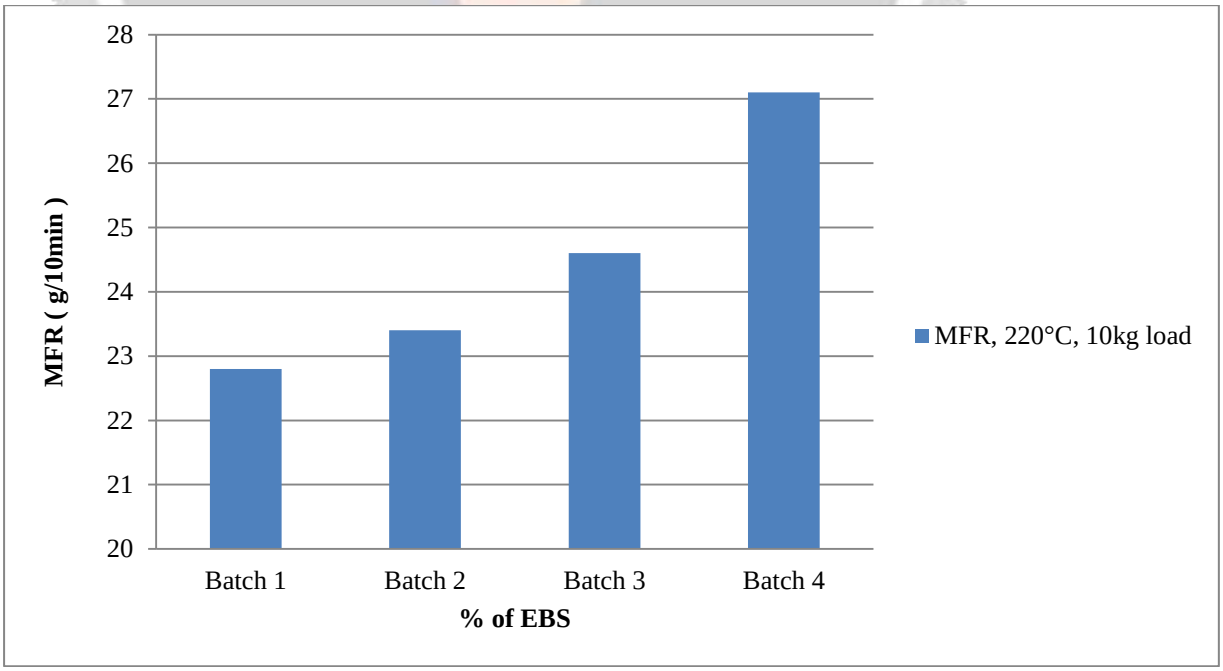

Chart -5: Melt Flow Rate v/s % of EBS

CONCLUSIONS

The result is that the above composition will improved melt flow characteristics and the formed article will a smoother surface and is more readily released from a metallic mold or die. Studied effect of EBS as lubricant in Glass filled ABS and SAN composition are up to 2 phr. Inference up to 2 phr or precisely between 1.5-2.0 phr addition of EBS does not have any adverse effect on mechanical properties. Also with addition of Glass Fiber to increase the heat resistivity.

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