

Development and Characterization of Polyurethane Coating On Steel Cop's For Yarn Winding Application

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ABSTRACT

Steel cops with Acrylonitrile Butadiene Styrene(ABS) sleeve, manufactured by an extrusion process, is generally used in yarn winding application. During the yarn winding, ABS sleeve is found to deform and fatigue failure occur after 20-25 days because of low compressive strength and low creep resistance. In order to control the deformation and premature failure, it is proposed to carry out urethane based coatings on steel cops and evaluate the performance of coating material during the usage. The experiments was performed to vary the thickness(layer by layer) of the coatings. Different techniques of coating will be used based on the rheology of the coating materials. The microscopic evaluation of coating carried out by scanning electron microscopy. The analytical techniques like FTIR, DSC, TGA employed to characterize the coated material. The effect of coated layers on coefficient of friction also measured. The test results further analyzed for the performance evaluation of the coating w.r.t. overcoming the deficiencies in the available cops which include the compressive strength and creep resistance.

Keywords: Acrylonitrile Butadiene Styrene, Coating, Polyurethane ,Differential Scanning Calorimetry

1. INTRODUCTION

Polyurethane is one in the foremost versatile material. PU having good abrasion resistance and good creep resistance. It is made by reacting a polyol (an alcohol with more than two reactive hydroxyl groups per molecule) with a diisocyanate in the presence of suitable catalysts and additives. The high thermal resistance, high tear resistance, strong adhesion to metal surface, toughness values, of Polyurethane (PU) make it an important material for industrial applications. Short Glass fiber is reinforcement material, it is added to plastics when to improve their mechanical properties. The hardener is added to PU to make improve the performance of material. strength, harness, wear resistance and also improve the curing time.

This research related to raise the compressive strength and abrasion resistance of PU by applying coating on the surface of the steel cop's. . In this work we aimed to produce composites of PU/HARDENER/ANTI-STATIC AGENT with varies range from 15% and study about their effect on properties.

2. MATERIAL AND EXPERIMENTAL PROCEDURES

2.1 MATERIALS:

PU material was procured from Industrial product manufacturing company Pune , Western Polyurethane - Ahmedabad and Nippon paint india private limited Delhi .

Table -1 source of PU resin

| | | |
|---|---|---|
| Polyurethane | Polyurethane | Polyurethane |
| Source:- Industrial Products manufacturing company Pune - India | Source :- Western Polyurethane - Ahmedabad, India | Source:- Nippon paint india private limited -Delhi, India |
| Grade:- PU101 | Grade:- PU109 | Grade:- nax superio 841 |

2.2 METHODOLOGY

2.2.1 HAND LAY UP METHOD

Hand lay-up technique is the simplest method of coating processing. The processing steps are quite simple. take polyurethane of grade 101 of IPMC-PUNE of 200 ml and take 10 ml of hardner of IPMC-PUNE into bicker. mix the material properly with the help of stirring rod. keep the mixture continuously stirring up to 10 min so that mixed it well. Clean the steel cop's before applying polyurethane coating on it with help of toluene or methanol, see that there should no dust particle on the steel cop's. With the help of paintbrush applied polyurethane coating of steel cop's. make sure that accuracy and thickness are maintained. Once the coating is applied, keep it for curing at room temperature for 2 to 3 hours. after the complete curing is done applied the second layer of polyurethane coating on the steel cop's. As per the requirement, the layer of coating can be done.

2.2.2 SPRAY LAY UP METHOD

Spray lay up technique is aforementioned to be an extension of the hand lay up methodology. In this technique, a spray gun is employed to spray pressurized resin that within the type of liquid. . Clean the steel cop's before applying polyurethane coating on it with help of toluene or methanol, see that there should no dust particle on the steel cop's. The spray gun is filled with polyurethane material and will be spray on the steel cop's. After spraying resin to required thickness, curing of the product is done either at room temperature or at elevated temperature.

Composition

| BA PU(85)+ HARDENER(15)+ BATCH NUMBER | DETAIL OF MATERIALS | COMPOSITION |
|---|------------------------|---|
| 1 | PU(101) | PU(85)+ Hardener(15)+2% Antistatic agent |
| 2 | PU(109) | PU(85)+ Hardener(15)+2% Antistatic agent |
| 3 | PU(841) | PU(85)+ Hardener(15)+2% Antistatic agent |

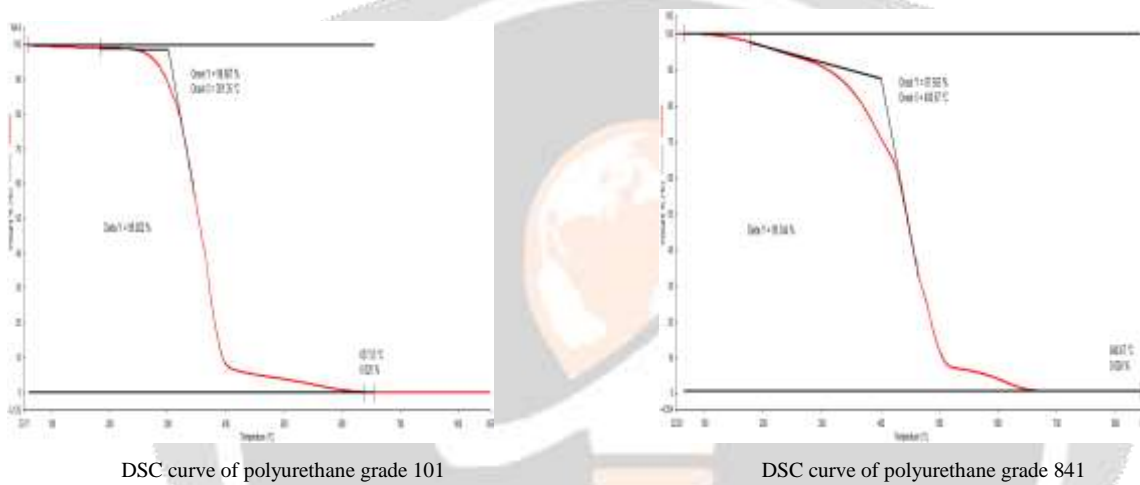
SPECIMEN PREPARATION

For the various tests, The test specimens were produced by using open mould. The mould having dimension of 10cm *10cm and having thickness of 2 mm. Before feeling material into mould the mould surface should be clean and dust free. A releasing agent is applied on the surface of the mould to avoid the sticking of the material to surface. then the material is filled into mould and keep for the curing in to environment temperature and various test specimens were produced to carry out various test.

3 RESULTS AND DISCUSSIONS:

3.1.1 DIFFERENTIAL SCANNING CALORIMETRY (DSC)

The chart 1 shows the results of DSC tests.



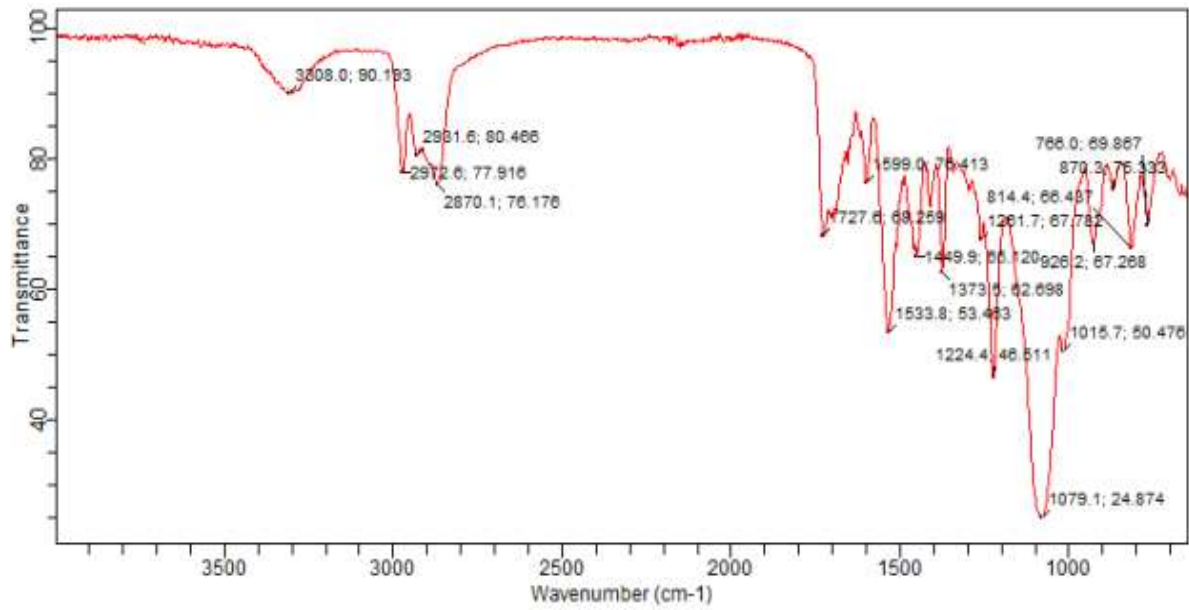
3.1.2 hardness test

The table 2 shows the results of hardness tests.

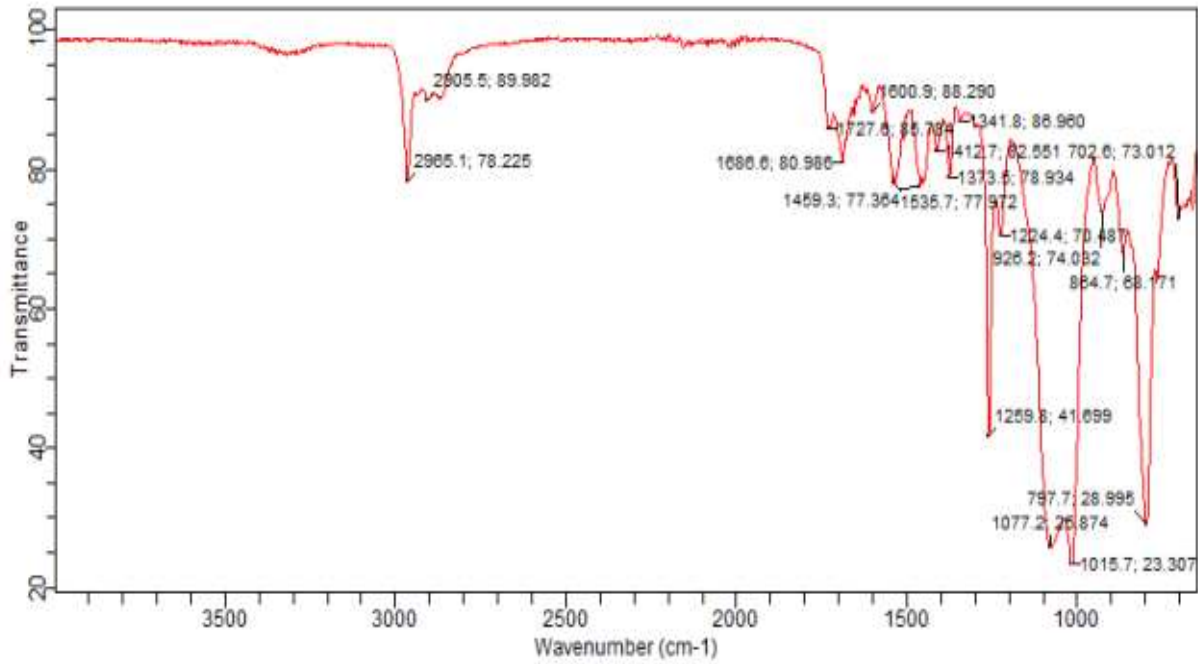
| Detail of materials | Results | Unit |
|---------------------|---------|---------|
| Grade 101 | 60 | Shore A |
| Grade 109 | 65 | Shore A |
| Grade 841 | 58 | Shore A |

3.1.3 Fourier Transform Infrared Spectroscopy (FTIR)

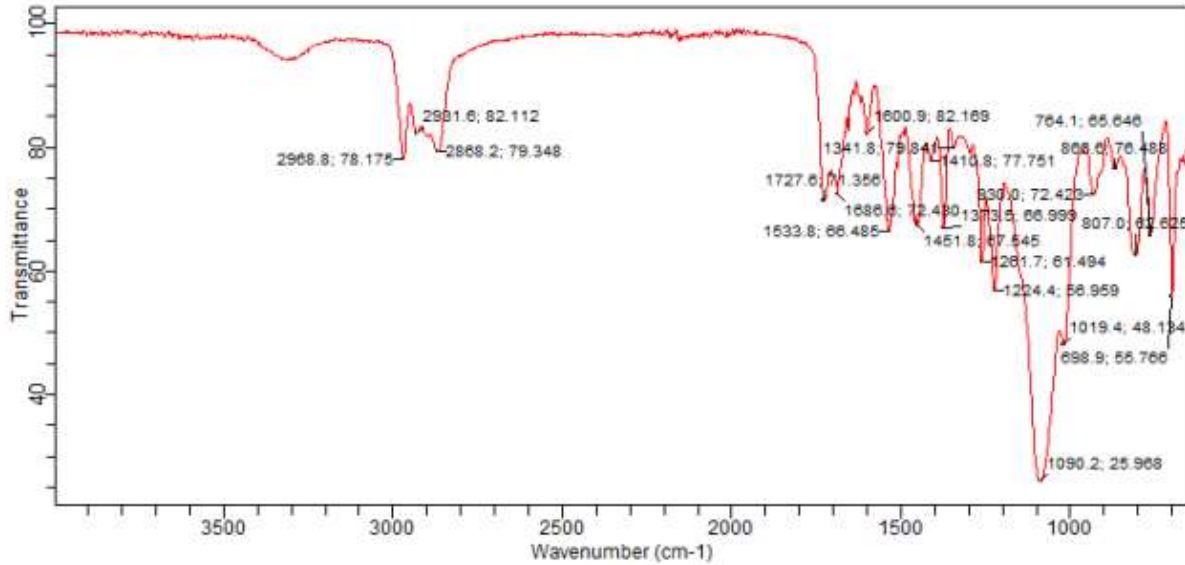
The chart 3 shows the results of FTIR test



Polyurethane Grade 101 coating



Polyurethane Grade 109 coating



Polyurethane Grade 841 coating

4 Conclusion

The results of table 2 of harness show that the polyurethane grade 109 has better hardness compare to other grade of polyurethane and it is also show that has better adhesion between steel cop's and polyurethane. The results of DSC graph show that has high melting point so that material can work under the extreme temperature and also show that glass transition temperature of polyurethane . The graph of FTIR show that composition of material .

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