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Studies on vicat Softening Point

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ABSTRACT; Thermoplastic do not have a melting point which precisely marks the transition from solid to fluid, but rather than under go a slow softening as temperature increases. Vicat softening temperature was therefore introduced to measurement technology as a substitute value for melting point. it describes the temperature at which a circular indenter with a cross section of 1mm² under a standardized loading of 10n or 50n penetrates exactly 1mm in to the specimen. Heat deflection temperature is the another such a method to determine the effect of temperature on plastics, for which a prismatic specimen is subjected to flexure loading and the temperature increased at a specified rate. The possibility of using the vicat softening point test as an additional method to find the phase behavior of amorphous polymer blends is discussed. The comparison of the TgS by DSC to the vicat temperatures of three blends, miscible, immiscible and partially miscible, allows us to interpret the different vicat softening temperature- blend composition plots obtained and to be informed on the phase behavior of the blends. The utility of the vicat softening point is rationalized one step further. Light is thrown on vicat measurements and they are interpreted from a qualitative view point; it is stated that the vicat softening point is nothing but a temperature at which the modulus has reached a particular level. So the vicat softening point is not just an arbitrary point measurement but a well-defined point in the modulus-temperature diagram, being related to the fundamental properties of the material. This interpretation enables one to understand and control the thermal behavior of polymers, especially in developments of new blends where a target vicat softening point is often pre-specified.

The validity of the above statement is established through experimental work. The quantitative values of modulus levels related to different vicat measurements are estimated. The vicat values generally supplied in material literature can now be used for design purposes and for other critical structure calculations which are nowadays a common practice for the plastics designers.

I. INTRODUCTION

Vicatsoftening point or Vicat temperature is the determination of the softening point for materials that have no definite melting point, such as plastics The Vicat softening temperature is the temperature at which a flat-ended needle penetrates the specimen to the depth of 1 mm under a specific load. The temperature reflects the point of softening to be expected when a material is used in an elevated temperature application. Standards to determine Vicat softening point include ASTM D 1525 and ISO 306, which are largely equivalent.[1] Property information for specific grades of resin are available in the Prospector Plastic Database. Property Search lets you search for plastics by more than 400 material properties. Vicat Softening Temperature - ISO 306

The vicat softening temperature can be used to compare the heat-softening characteristics of different materials.

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Four different methods may be used for testing.

Method	Load (N)	Heating rate (K/h)
A50	10	50
B50	50	50
A120	10	120
B120	50	120

The deflection temperature is a measure of a polymer's ability to bear a given load at elevated temperatures. The deflection temperature is also known as the 'deflection temperature under load' (DTUL, 'heat deflection temperature or 'heat distortion temperature' (HDT).

The table below lists average deflection temperatures at 0.46 MPa (66 psi) load, at 1.8 MPa (264 psi) load, and melting point values for some filled and unfilled polymers.

II. TESTING PROCEDURE

- VICAT SOFTENING POINT (ASTM D1525)
- HEAT DEFLECTION TEMPERATURE (ASTM D 648)

FABRICATION WORK:

*OIL TANK:

It is used to store the oil and we place the heater inside the tank.

Material used: mild steel Operations: Bending, welding, grinding, insulation



Preparation of Oil Tank

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***HDT SPINDLE**: It is used apply the load by placing the weights.



***VST SPINDLE**; It is used apply the load by placing the weights



***TENNON** :The tennon used only in HDT testing method. It is used in the HDT apparatus to place the specimen like simple beam.

Material used : mild steel

Operations : turning, drilling, forming, tapping



IV. PROCURED ITEM

a) **VACCUM OIL:**

Vacuum pump oil is an excellent product formulated from veryhigh viscosity index base stocks which are deep refined additivesto impact-excellent thermal stability, antiwar and extremepressure properties.They are designed to help the built up vacuum to sustain for a longer time. This product is mainly used in very type of diffusion pumps in vacuum system.

b) **ARDUINO UNO BOARD:**

The Arduino Uno is a microcontroller board based on the ATmega328.The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Ground and Vin pin headers of the power connector.

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The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

c] PT100 SENSOR:

PT 100 sensor is used to measure the temperature. It is a complete unit consisting of a platinum RTD, stainless steel. It is controlled through the microprocessor. Designed for temperature reads in harsh environment. Ensure probe is immersed in the center Always use heat transfer compound in thermal well, Always install as close as possible to position where temperature control is required ensure probe is installed a minimum of 6×pipe diameter

d] HALL EFFECT SENSOR:

Hall effect sensor it is used to controlling the temperature. Position transducers based on the Hall effect are often used in automotive and industrial products because they can provide long life at a relatively low cost. Since the sensitivity of a Hall effect element is based on measuring the magnetic field at a specific point within the device package, a single element provides for a relatively short stroke linear position sensor (less than 25mm stroke). Longer-stroke-length transducers can be made by using mechanical advantage or by incorporating an array of sensing elements, but the benefit of lower cost is then reduced. Hall effect sensors measure the strength and polarity of a magnetic field. A Hall Effect linear position transducer includes at least a Hall device, a position magnet, and associated electronic circuits. The position magnet is attached to the element to be measured. As the magnet approaches the Hall device, the strength of the magnetic field increases, and the output of the Hall device increases. Since the change in magnetic field strength is due to a change in the magnet position, the Hall device produces an electrical output that varies with changes in the position of the magnet. The polarity of the magnetic field is indicated by the polarity of the electrical output.

V. RESULTS

1]HDT Testing Result

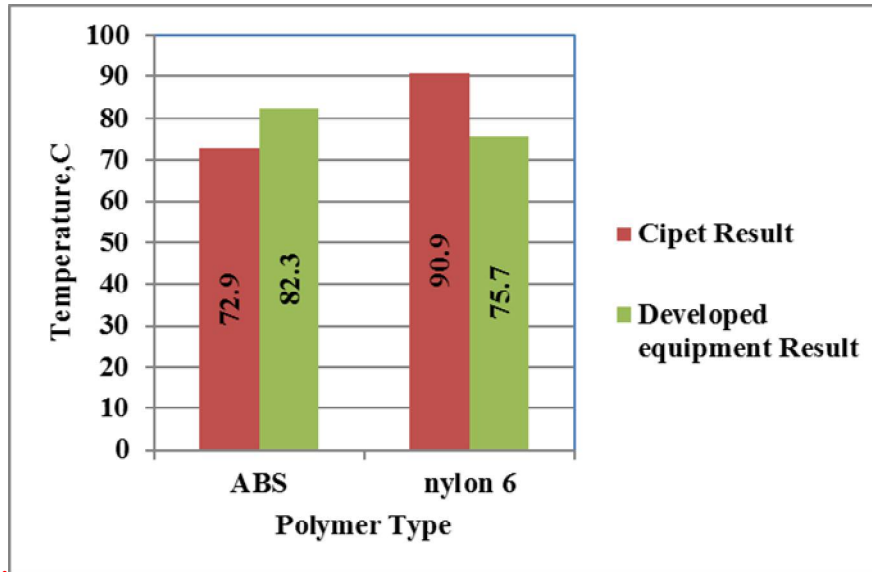
POLYMER TYPE	CIPET Results	Developed equipment Result
ABS	72.9	82.3
nylon 6	90.9	75.7

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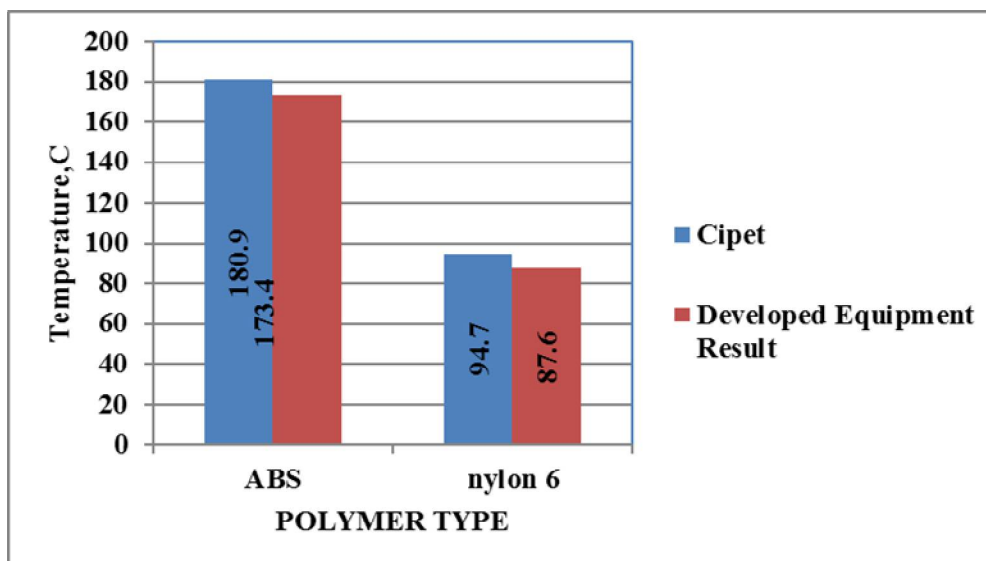
HDT values for ABS and N6 materials



Temperature vs. Materials (HDT Setup)

2] VST Testing Result

POLYMER TYPE	Cipet Results	Developed Equipment Result
ABS	180.9	173.4
Nylon 6	94.7	87.6



VST values for ABS and N6 materials

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Temperature vs. Materials (VST setup)

The results of the tests conducted on the developed HDT and VST test setup has been shown in the figure 5.1 and 5.2. The prepared test samples (Injection molded) were tested in CIPET (Central Institute of Plastics Engineering and Technology) Labs, Mysore and similar samples were tested on our developed equipment. The results indicated that samples have more or less shown the same readings. Further, calibration of the machine would be carried out and would be developed as a setup for commercialization.

VI. CONCLUSION

To conclude, the final temperature of the softening point is 48.75 which match the theoretical value which is 48 to 52 . The objective of this experiment was achieved. During conducting the experiment, there are some errors that occurred which will affect the final result. In order to prevent this from happening, there are methods to improve the experiment's result. Before doing the experiment, make sure the Ring holder does not hold the Ball guide in stationary. Adjust the ring until the ball can pass through freely. In addition, to get good results, ensure you conduct the experiment in room temperature condition. The purpose of this test in the industry is to estimate viscoelastic properties of both asphalt and a paving mixture especially in road design. This is to test the consistency of bitumen.

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