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DESIGN OF PEEL TESTER (LOW COST) FOR CHECKING ADHESIVE STRENGTH OF TAPES

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ABSTRACT

The Synopsis mainly focuses on measuring peel strength of adhesive tapes. Peel strength is average force required to separate two boded materials from one another, is properly applicable to various industries aerospace, automotive, adhesives, packaging, biomaterials, microelectronics, and more. Peel test data is used to determine the quality of the adhesive joint and, where applicable, provides information on the effects of processes. Peel tests are constant-speed tests in the tensile direction. In material testing, peel strength is calculated after measuring and averaging the load to peel the specimen and dividing the average load by unit width of the Adhesives. Different adhesives are used for joining the different types of materials. The different types of peel tests available for investigating the adhesive strength are 90º, 135º, 180º and T-peel test. This mechanism mainly focuses on 180º peel type test

Keywords: Peel Strength, 180º Peel Test, Motor Having Low Rpm, Leadscrew, Measuring Gauge.

I. INTRODUCTION

A Proposed Mechanism for Peel Strength Measuring Machine is mainly focused on measuring the Peel strength of adhesive tapes. Peel strength is very important factor for any type of adhesive. Because it plays very important role for the selection of adhesive and as per the requirement parameter. Peel strength is generally used to measure the bond strength of a material, typically an adhesive. Peel strength is the average load per unit width of bond line required to separate bonded materials where the angle of separation is 180 degrees. Peeling tests are the practice of testing adhesion properties of film bonded to substrate, usually by tensile. The peel strength determines the adhesive strength (also called the adhesive fracture toughness). Physical testing of packaging products by peeling can tell us a lot about its properties and manufacturing process such as sealing consistency, bonding strength, adherence ability, cohesive properties of the interface, bond durability and other parameters. Measurements require a force gauge, suitable grips (capable of clamping the tape firmly and without slippage throughout the tests) and a motor driven mechanism to pull the product under test at a steady rate and controlled angle. Clamp the bent and unbonded ends of the test. Apply the force measure and record the force response. Ideally the force versus displacement reading to initiate and propagate the response should be recorded.

II. LITERATURE REVIEW

1) In this paper the study of peel test strength and hardness of spot weld of dissimilar materials by resistance spot welding. The resistance spot welding is a professional welding method. In this experiment used materials mild steel and stainless steel. Resistance spot welding widely used in automobile industry and aerospace industry. The aim of this paper, analysis of weld joint strength and hardness, some mechanical properties have effect during experiment time. The name of mechanical properties is welding time, welding force, welding current, welding nugget size. The strength and hardness have very important role in joint of dissimilar spot welding. In the peel test the shape of sample is “L”. In this experiment, the welding force is constant but current and time are variable.

Keywords: Dissimilar Material, Peel Test, Resistance Spot Welding, Hardness Of Weld.

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2) Different adhesives are used for joining the different types of materials. The different types of peel tests available for investigating the adhesive strength are 90º, 135º, 180º and T-peel test. This paper reviews the different peel tests available as well influence of other factors for determining of peel resistance between two materials. The investigation of adhesive strength helps to select a proper adhesive material for joining of two different materials. The paper briefs the effect of peel angle, different types of peel tests such as 90º and T-peel test, temperature, moisture, thickness, the rate of change of peeling rate on peel strength.

Keywords: Adhesive Bonding, De-Lamination, Interface Adhesion, Peeling Test.

3) The peel resistance of four adhesives ("J-B Weld" by J-B Weld (adhesive A), 3 M Scotch-Weld DP 125 Gy (adhesive B), Loctite PL Premium (3x) Construction Adhesive (adhesive C), and Henkel Hyson EA9394 (adhesive D)) is investigated for their bonding performance of a styrene-ethylene/butylene-styrene– carbon black (SEBS– CB) composite membrane used in structural health monitoring (SHM) applications. Tests are performed on membrane samples bonded on four common structural materials, namely aluminium, steel, concrete, and fiberglass, to obtain the peel resistance of adhesives. Results show that adhesive B has the highest strength for aluminium, steel, and fiberglass substrates, and that adhesive C has the highest strength for the concrete substrate. The performance is also evaluated versus adhesive cost, a critical variable in SHM applications. Here, adhesive C performed best for all substrates. Lastly, membrane residuals resulting from the peel tests are compared. Tests show that Adhesive B resulted in the highest residual percentage for aluminium, while adhesive C performed better for all other substrates. However, membrane residuals for adhesive C do not show a positive correlation with the peel resistance.

Keywords: Peel (C), Peel Strength, SEBS-CB, Sensor Adhesive.

4) Adhesive strength refers to the ability of an adhesive to stick to a surface and bond two surfaces together. It is measured by assessing the maximum tensile stress needed to detach or unstick the adhesive perpendicular to the substrate. To measure this adhesiveness there is a device called Adhesive Tester. adhesiveness tests are the practice of testing adhesion properties of film bonded to substrate, usually by tensile. The adhesiveness strength determines the adhesive strength also called the adhesive fracture toughness. Physical testing of packaging products by adhesiveness can tell us a lot about its properties and manufacturing process such as sealing consistency, bonding strength, adherence ability, cohesive properties of the interface, bond durability and other parameters. This device covers the measurement of the adhesiveness adhesion of pressure sensitive tapes. adhesiveness adhesion is the force required to remove a pressure sensitive tape from a test panel or its own backing at a controlled angle and at a standard rate and condition. An adhesiveness test is performed between two substances bonded together with an adhesive. The substrates may be both flexible or one may be flexible while other is rigid.

Keyword: Adhesiveness Testing, Testing Machine, Peel Testing And Different Surface.

5) The paper mainly focuses on measuring peel strength of adhesive tapes. Peel strength is average force required to separate two boded materials from one another, is properly applicable to various industries aerospace, automotive, adhesives, packaging, biomaterials, microelectronics, and more. Peel test data is used to determine the quality of the adhesive joint and, where applicable, provides information on the effects of processes. Peel tests are constant-speed tests in the tensile direction. In material testing, peel strength is calculated after measuring and averaging the load to peel the specimen and dividing the average load by unit width of the Adhesives. Different adhesives are used for joining the different types of materials. The different types of peel tests available for investigating the adhesive strength are 90º, 135º, 180º and peel test. This mechanism mainly focuses on 180º peel type test. Key point of this study is to get precise reading by 180-degree peel strength measurement machine. In this mechanism of peel strength measuring machine that the motor which having low rpm will drive power screw with help of coupler. rotating motion of leadscrew will then convert into linear motion of table. Supporting bars support table mounted on leadscrew and adhesive strength will be tested with help of measuring gauge. 180-degree peel strength measuring machine can measure adhesiveness of tape applied on any surface with higher accuracy. It will require zero lubrication and maintenance cost is also low. Machine is cheaper in cost and faster in working.

Keywords: Peel Strength, 180º Peel Test, Motor Having Low Rpm, Leadscrew, Measure.

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III. PROBLEM STATEMENT

Currently industries are using the peel strength measuring machine which works on the mechanism of '90° peel test type A' in which the complexity of the machine is very high which resulted in high cost of the machine. But as peeling angle increases the accuracy will also increases, so we are focusing on '180° peel test type B' as per ASTM standard D3330. Hence to reduce machine complexity and cost , it is necessary to design and developed low-cost digitalized peel tester.

IV. OBJECTIVES

1.Design of peel test mechanism.
2.Load cell implementation.
3.Digitalization of reading.
4.Guide design.

V. CONSTRUCTION AND WORKING

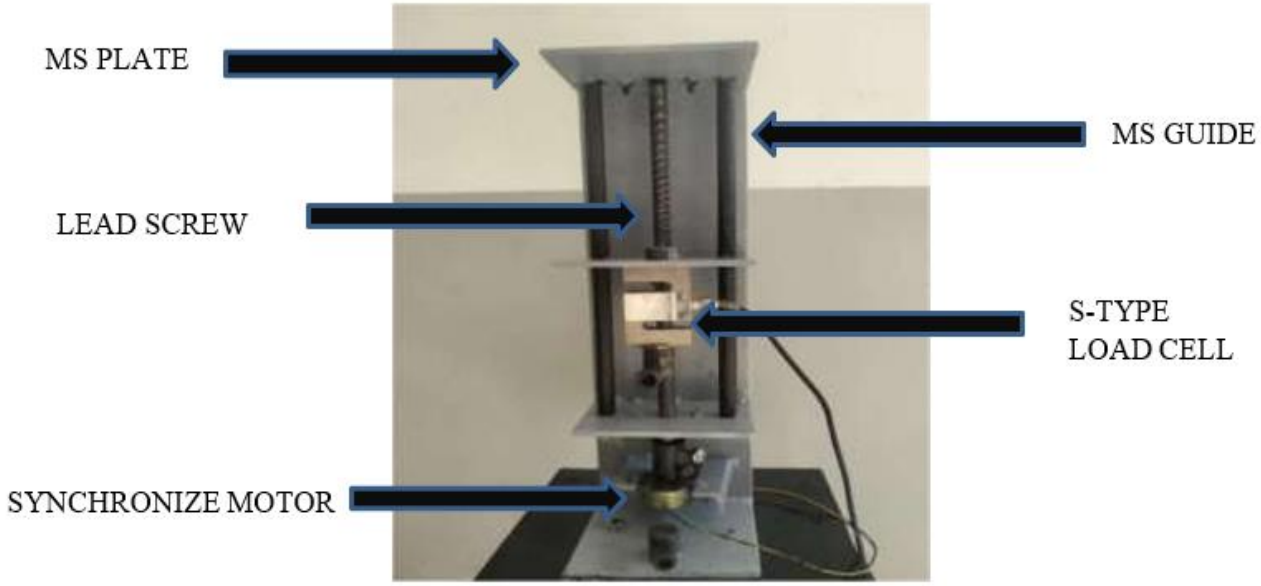

Fig 4.1 Machine Construction

1.Insert the tail of the sample into the roller jaw and pull gently to lock. Wrap a piece of paper around the tail to keep the grip free from gross contamination by the adhesive.

2.Pull the sample back on itself [180°] attempting to maintain a speed sufficient to move the adhesion test front 25 mm (1") in 10 seconds using the marks as a guide to peel speed. This will give a movement of the roller grip of 300 mm/min (12"/min) -- more if the carrier film stretches. It may be impracticable to strictly control the test speed under changing environmental conditions.

3.Record the average and maximum loads shown on the spring balance in kilograms. 4.Calculate the peel strength by multiplying the average load by 9.81 to convert to Newtons and divide by 25mm/1" [or the peel strip width in mm if appropriate] to give the peel strength in Newton per millimeter width [N/mm].

VI. ADVANTAGES

1. High strength efficiency
2. High torque
3. Good measuring quality
4. It can be measure many packaging tape strength
5. Operation is noise less
6. More accurate.

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VII. COMPONENTS OF PEEL TESTER

7.1 AC Synchronous motor

Figure No-7.1 AC Synchronous Motor

Rpm = 5-6rpm , Voltage = 220v , Synchronous Power = 4w

A synchronous electric motor is an AC motor in which, at steady state, the rotation of the shaft is synchronized with the frequency of the supply current; the rotation period is exactly equal to an integral number of AC cycles. Synchronous motors contain multiphase AC electromagnets on the stator of the motor that create a magnetic field which rotates in time with the oscillations of the line current. The rotor with permanent magnets or electromagnets turns in step with the stator field at the same rate and as a result, provides the second synchronized rotating magnet field of any AC motor. A synchronous motor is termed doubly fed if it is supplied with independently excited multiphase AC electromagnets on both the rotor and stator. Adhesive peel tester machine motor generate force for rotating the middle screw and varied the middle plate. In this peel tester which uses only one synchronous motor this rotate the clockwise and anticlockwise. The motor device which used to convert rotating motion to reciprocating motion. The synchronous motor and induction motor are the most widely used types of AC motor.

7.2 Lead Screw

Figure No-7.2 Lead Screw

Rod Length = 360mmDiameter = 18mm

The rod used for the plate varies from downward to upward and upward to downward. Rod rotate by motor with 5 rpm and varies the middle plate, Rod fit into the lower bearing and upper bearing. With respect to shape, stud bolts a.k.a. studs are categorized into three basic types: "fully threaded stud bolts", "tap end stud bolts", and "double end stud bolts". Each of these studs have different application. As name suggests, fully threaded studs have full body coverage with threads for full engagement of the matings nuts or similar parts. Tap end studs have threads at extreme ends of the body with unequal thread engagement length. while double end stud bolts have equal thread length at both ends. Apart from these there are stud bolts for flanges which are fully threaded studs with chamfered ends, and double end studs with reduced shank for special bolting applications. For studs that are not completely threaded, there are two types of studs: full-bodied studs, and undercut studs. Full-bodied studs have a shank equal to the major diameter of the thread.

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7.3 Load Cell

Fig.7.3 Load cell

S-type load cells are mainly used to measure tensile forces, but also are suitable for compressive force measurement. As the name implies, these load cells are shaped like the letter S. The spring element is located in the center beam of the load cell. S-type load cells are mainly used to measure tensile forces, but also are suitable for compressive force measurement. As the name implies, these load cells are shaped like the letter S. The spring element is located in the center beam of the load cell. This element is a piece of metal that is elastically deformed under load and recovers the moment the load is removed. This deformation or strain is picked up by strain gauges installed on the spring element and converted into an electrical signal. In S-type load cells, the spring element is deformed at both ends by compression or tension. In contrast to other load cells, S-type load cells can be calibrated in weight units and also in Newton, as they are widely used as force transducers.

VIII. APPLICATION

1) Material Packaging center
2) Food industry
3) Medical equipment packaging

IX. CONCLUSION

Peel Strength Tester is widely used testing machine which is used in different packaging products manufacturing e strength of self-adhesive products such as tapes, labels and many more. The adhesive products are tested to measure the maximum amount of force that an adhesive material requires to leave another substrate on which it is applied. Peel Strength Test is one of the best testing machines which are used to measure the bonding strength of the packaging materials. The test is performed to ascertain the bond strength of the adhesives even in tough working conditions. These tests are tools for quality assurance control and use, the benefit of performing objective, accurate and repeatable peeling testing can improve product consistency and assess interface adhesion. It is expected to cost of other systems currently on the market is high. Bottom line is it help not only to just reduce the price of that machine but it can give e mechanism to perform peel strength test. The adhesive products are tested to measure the maximum amount of force that an adhesive material requires to leave e of the best testing machines which are used to measure the bonding strength of the packaging materials.

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