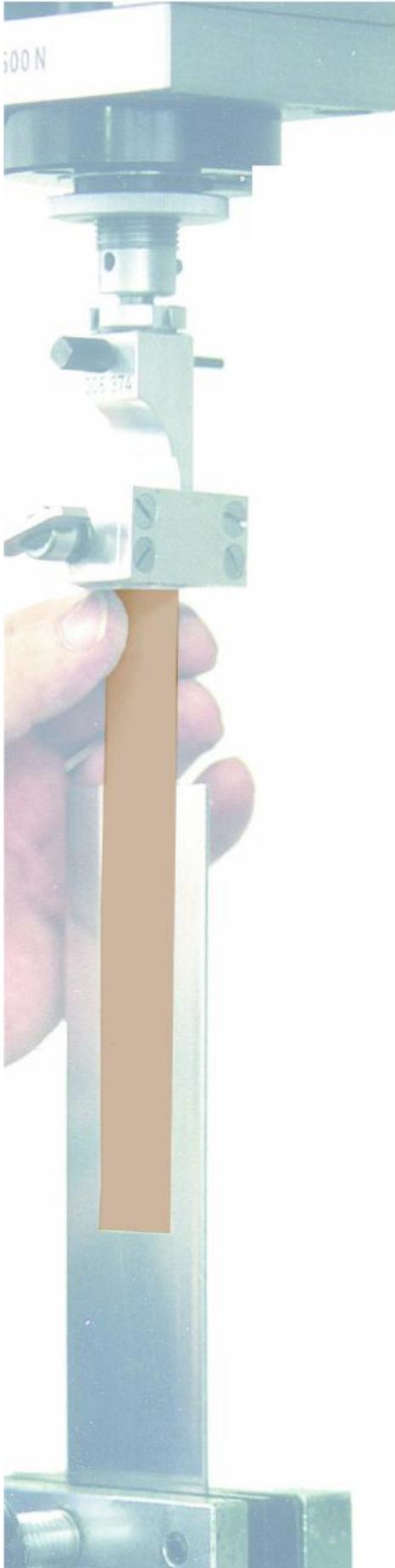




CONTENT

peel adhesion	2
breaking load	4
rolling ball	6
shear adhesion	7
carton test	9
summary	
test methods	11



PEEL ADHESION

Testing the peel adhesion on stainless steel

1. Definition

Peel adhesion - The force required to remove an adhesive tape with a specific width under defined conditions (unwinding-angle, pressure, speed) from a standard metal surface.

2. Nature of Test

An adhesive tape with a length of approx. 400 mm and a testing width of 25 mm is applied to a stainless steel plate, 200 mm long, 50 mm wide and about 2 mm thick and then pressed on evenly with a metal roller of 2 kgs.

Due to the fact that 80 % of the packaging self adhesive tapes are wider than 25 mm, a piece in 25 mm width shall be cut from the original roll.

From this prepared steel plate, approx. 25 mm of the tape shall be peeled off.

The steel plate is fixed in the moveable clamp of the testing machine; the free end of the tape is fastened with another clamp.

With a defined speed of 300 +/- 30 mm per minute the adhesive tape shall be removed from the steel plate whereas the testing machine continuously reports the values via display.

After completion of the test, the central value is automatically calculated, which is the

Peel Adhesion on Steel.

The value so obtained is expressed in Newton (N), i. e. the force necessary to remove the adhesive tape from the steel surface, and the testing width (25 mm): $N/25 \text{ mm}$.

Different average values have been defined and fixed for the various types of adhesive (natural rubber, synthetic rubber, and acrylic) and formulations.

3. Conditions

Apart from the precise accomplishment of the individual steps it has to be considered that the cleanliness of the stainless steel plates influence essentially the results. The applied steel plates - their composition of is of course exactly fixed and must be respected - will be regularly cleaned with solvent before and after each application - certainly in longitudinal direction to avoid unevenness in the surface.

An equally important point is the defined conditioning of the room in which the tests are carried through.

The weight of the metal roller used is exactly defined and has to be observed. The diameter of min. 50 mm must comply with the strong prescriptions.

Also important for the test: The three outer layers of the adhesive tape roll shall be discarded before taking the specimen.

This Afera test method 4001 has been developed for the production control and the determination of specifications. In monta Klebebandwerk GmbH, the results of the peel adhesion test decide about the release of an adhesive tank mixture (approx. 40.000 sqms), the coated jumbos and the finished products.

Even "non-professionals" make use of the peel adhesion tested according to Afera, e. g. for product comparisons.

In the "real life", however, the value of the peel adhesion is not the only decisive factor: Criteria such as carton surface, contact pressure, storage and room temperature are of essential importance, too.

In our next editions of "monta News" we will present further test methods.



Breaking Load

1. Definition

Breaking load - The force which is necessary to break a strip of tape which is exposed to a certain tractive power.

2. Nature of test

As already described in the testing of the peel adhesion, a sample with a width of 25 mm is necessary.

The outer layers of the tape roll to be tested will be taken off and then a total of five test strips will be cut out with a length of 200 mm each.

Before the test the sample strips are conditioned for 2 hours in a defined area in order to avoid tensions and a potential stretching which could have occurred during the unwinding.

These sample strips are fixed in the so called tractive power testing machine so that the longitudinal axis is oriented vertically and makes up a line with the direction of the used force.

The sample strips fixed with clips are stretched with the defined speed of 300 +/-30 mm per minute until they break. Via a display the testing machine is showing continuously values.

The central value of these tests is the

Breaking Load,

which is stated in units of the necessary force (N) and the sample width (25 mm)?

Depending on the support and the thickness of the support the central values are different and fixed accordingly.

3. Conditions

The test results are depending to a high extent of the testing machines and the conscientious carrying out of the test.

Perfect equipment (secured by continuous maintenance and/or calibration), leanliness, conditioned areas and above all a trained staff are the first priority. Thus we really secure exact test results.

The breaking load defined according to AFERA 4004 explains the uniformity and quality of a tape, as well as the capability to withstand pressure during the application.

The testing of breaking load is a measure method which accompanies our tape production from the coating until the final product. The measured values of the various steps of production are certainly fixed in writing.

Thus we also fulfil the requirements for documentation according to DIN EN ISO 9001 - an important part of the extensive auditing catalogue of the certification institute. We passed our post-audit, carried through by LGA InterCert, successfully.

Our new certificates DIN EN ISO 9001 and DIN EN ISO 14001 can be made available upon request or can be found at www.monta.de.

ROLLING BALL

1. Definition

With the test method "rolling ball", the tack, i. e. the immediate adhesion, is determined.

2. Nature of test

The outer layers of the adhesive tape to be tested are removed and a piece of 20 cm length is applied on graph paper with the adhesive side up. The rolling ball testing device slightly overlaps the adhesive tape.

The cleaning of the necessary steel ball (type, weight and diameter are defined) is done on dry cellulose pads with acetone. The dried steel ball is placed on the rolling ball device with metal tweezers and after releasing the "brakes" it rolls over the inclined plane onto the adhesive tape.



The distance covered by the steel ball starting from the lower edge of the testing device defines the

rolling ball value

indicated in cm.

Depending on the type of adhesive, different rolling ball results are achieved.

3. Conditions

As for all tests carried through, the basic conditions (cleanliness, air humidity, ambient temperature et cetera) are strictly followed and observed, also for the rolling ball test.

The term "tack" stands definitely for the initial adhesion/wet grab on a steel surface and cannot automatically be equated with the initial tack on a carton surface. In this context the wetting of the carton surface with the adhesive is of great importance. The initial tack of natural caoutchouc adhesives is better compared to hotmelt and acrylic adhesives as they are harder due to their characteristics.

SHEAR ADHESION

1. Definition

The static shear adhesion describes the time needed by an adhesive tape sample to "shear off" from a defined surface when being exposed to a steady load.



2. Nature of Test

From a tape roll two test samples of 1 cm width are taken. These stripes are stuck in a length of 1 cm onto a defined piece of test carton and pressed with a roller four times on the carton. The testliner with the now obtained test surface of 1 cm² is then fixed vertically in a support. The bottom end of the test sample now is formed to a loop to which a weight of 565 g is fastened. The resulting weight exposure leads to the "shearing off" from the tape.

The length of the shear time is recorded via a time measurement device and the value obtained is stated in hours (h).

Depending on the type of adhesive, different shear values can be reached. The highest values can be stated for natural rubber and hotmelt adhesives. The results for acrylic adhesives, however, are in the minute area.

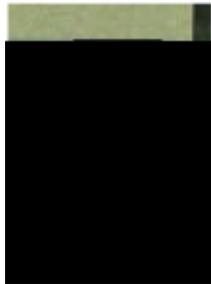
3. Conditions

As for all other tests, the basic conditions (cleanliness, air humidity, ambient temperature et cetera) are strictly followed and observed.

The shear test is carried out in an air-conditioned room.

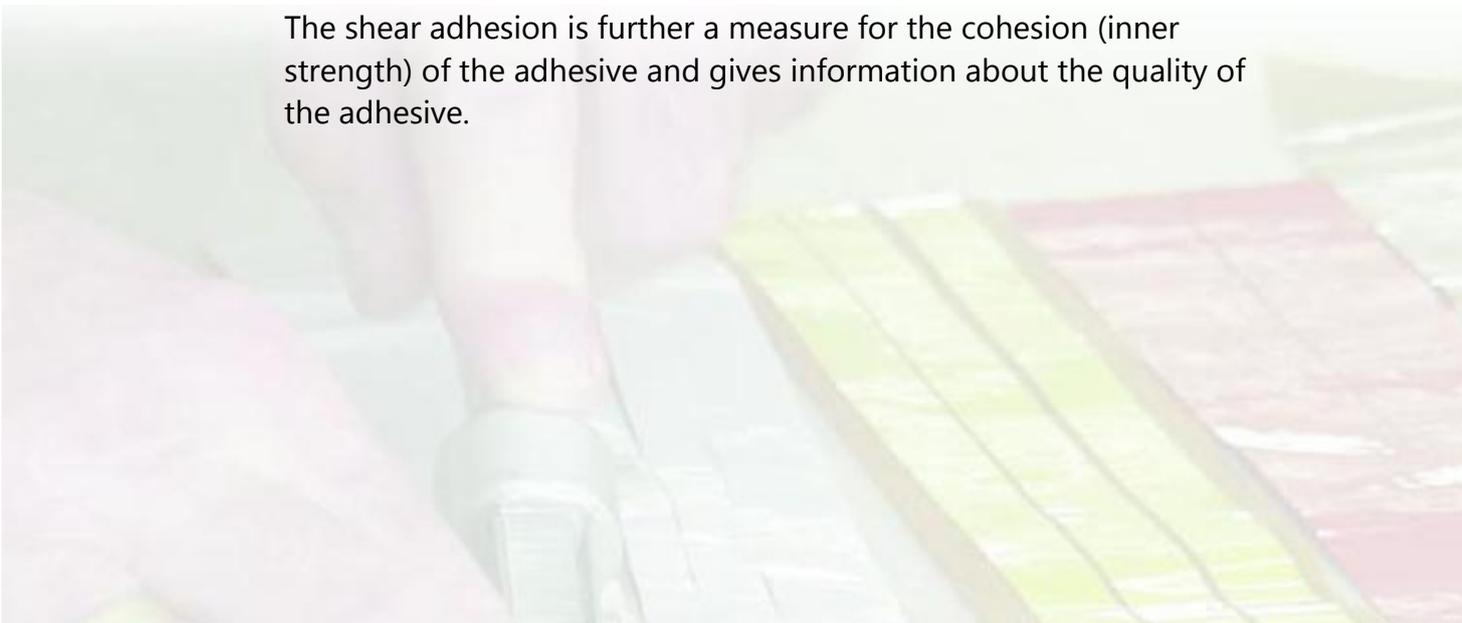
Especially stressed must be the use of an exactly defined recycling carton (testliner), a test plate cleaned and free from residue and then dried with a fluffless cloth, a steel roller (net weight 2000 g) as well as a standardized weight of 565 g.

The shear adhesion test is of high importance in monta. Therefore the testliner was deliberately chosen as test surface, whereas the Afera test method is based on a steel plate.



With this modification we respond to the realistic application requirements our self-adhesive tapes are faced with, i. e. the sealing of cartons made of paper and not of steel!

The shear adhesion is further a measure for the cohesion (inner strength) of the adhesive and gives information about the quality of the adhesive.



Test method carton test



All test methods already presented have one thing in common:

They are carried through according to internationally valid test instructions.

The carton test is a novelty and we will finalise herewith our series "Presentation of Test Methods"!

In addition to the "theoretical" standard tests this test has been developed and implemented in monta more than 20 years ago in order to achieve practical results regarding a permanent carton sealing.

1. Definition

Carton test - under defined conditions it is examined whether the applied adhesive tape peels off from a recycling carton being under pressure and whether the carton opens.

2. Nature of test

A carton is filled with cores which are by 2 - 3 mm higher than the internal height of the carton. By this means a counter pressure is produced supporting the reset forces of the carton flaps. The filled carton now is sealed with adhesive tape. According to the test procedure, the adhesive tape on the front of the carton overlaps by 5 cm. The carton is labelled with date, time and type of adhesive.

The filled and sealed carton is stored in our acclimatised room for 48 hours at a room temperature of 40° C and a humidity of 60 %.

Especially the combination of heat and humidity strains the adhesive tape:



- the humidity diffuses into the carton and thus affects the adhesive tape from outside and inside.

- the temperature and the tension caused by the overfilled cartons make high demands at the secure and permanent carton sealing (shearing off).

This test is carried through with every charge of adhesive. We are using multi-recycled cartons which are also applied in our production.

The test is only judged as "good" if the carton can be removed from the acclimatised room after 48 hours in its originally closed condition and without shearing off of the adhesive tape.

You all know that the reason for open cartons is at first always related to the quality of the tape - the last link in the packaging chain. Often it is not considered that - just like in real life - two parties belong to a permanent connection.

And that's the basis of the carton test.

This test method is only carried through in monta in order to give you



the
security
you need
each and
every day.

A permanent connection from carton and adhesive tape =
a successful and permanent connection between supplier and
customer.

Summary test methods

Which criteria have to be considered for a secure and durable sealing of a carton with self-adhesive tapes?

In the last editions of our monta News we continuously covered the most important test methods carried through to measure and guarantee the quality of our adhesive tapes.

To secure a durable sealing of the cartons, it is not enough to simply record and analyse individual measurement readings. It is rather important that the various parameters are interdigitated and harmonised.

The optimal interaction of the individually established values, combined with adequate and dry cartons free of dust, is the pre-condition for an efficient and faultless carton sealing. Only the total counts!

Example: adhesive tapes with an HM adhesive show adhesive strength values on steel of more than 1000 cN/25 mm. This individual statement does not shed any light on whether a carton out of cardboard - and not out of steel (as the test method prescribes) - really remains permanently sealed. Tack, shear and last but not least the carton itself has absolutely to be considered, too.

To what must one pay attention?

- **To the carton!**

The carton surface must not contain any separating agents such as silicone or wax and has to be dry and free of dust. The reset force of the carton flap must not be too high. Therefore a correct adhesion, die-cutting as well as a faultless fold of the carton are of importance.

- **To the adhesion strength**

in combination with tack and shear!

High adhesion strength values to steel alone do not guarantee, as already said, a continuous sealing of the carton.

Moreover, low adhesion strength levels do not necessarily indicate a low quality adhesive tape. The adhesion strength of a BOPP low noise with a natural rubber adhesive (monta pack 315), for example, shows values of 300 cN/25mm +/- 150 mm. Due to a high tack and a very good shear value, however, the cartons remain sealed without any problem!

- **To the shear**

in combination with adhesion strength and tack!

An adhesive tape with a high shear value and a good rolling ball result can have, despite of maybe low adhesion to steel values, good immediate and long-lasting tack features. The adhesive liaises in an optimal way with the carton surface.

- **To the tack**

in combination with adhesive strength and shear!

A good rolling ball result as for example 1 cm characterizes a "soft" adhesive, which immediately after the application nestles to the fibers on the carton surface. Acrylic tapes usually show acceptable rolling ball features, whereas the shear values are within minute's range. It is therefore important that tapes with an Acrylic adhesive are applied with maximum pressure. Also a period of up to 24 hours is necessary that the tape liaises optimally with the carton surface.

- **To the surface pressure!**

Without surface pressure the adhesive cannot liaise with the carton surface. Therefore in English speaking areas one rather talks about a "pressure sensitive tape" than a "packaging tape". Especially when applying the tape with a dispenser, you must make sure that the track is near to the carton to fix the tape

with the pressure flap along the total length of the carton and the front sides. When working with machine rolls, packaging machines automatically take over this step.

- **To the cohesion (internal bond of the adhesive)!**
If the cohesion is too low, the adhesive splits up and the carton opens.
- **To the application temperature!**
If it is too cold, every adhesive embrittles.
If it is too warm, every adhesive tends to become greasy or to embrittle (Hotmelt and Acrylic).

Even if adhesive tapes with a natural rubber adhesive perform at best in "extreme" temperatures, the application at room temperature is decisive for a long-lasting sealing.

When choosing the right adhesive tape for a special application, a multiplicity of different components has to be considered and harmonised. The decision making process therefore is not always easy. It is our duty to support you in all your questions regarding self-adhesive tapes.

Test us! We accept the challenge.