elconews e-zine
international
August 2005

BMW bodyshops, where quality is the key

Graham Culf – Elcometer UK, talks about BMW quality control in their approved bodyshop network.

The BMW brand is synonymous with quality, technology and high performance. As part of BMWs quality control procedures, they are purchasing over 100 Elcometer 2434 FRIKMAR Viscosity Cup for use in the bodyshops of their dealer network.

Using the FRIKMAR dip cup is a quick and reliable method for checking the viscosity of paints (and other liquids).

When spraying, it is important to have the viscosity of the paint within a pre-determined range so as to ensure a satisfactory surface finish. As the viscosity of the paint can alter under different storage conditions and with age, it is useful to be able to confirm that the paint is still within specification before using it.

The Elcometer 2434 FRIKMAR Cup, which measures the kinematic viscosity (flow) of paint, is a very easy to use dip cup, allowing quick checks to be made in the workshop.

If there are any discrepancies then the bodyshop will have the information they require to make appropriate changes and resolve the issue, guaranteeing the customer the quality finish they have learned to expect from BMW.

Liquid lunch

Sunny Nietubicz – Elcometer USA, reports on Dannon.

Pro-biotic drinkable yoghurt is big business today with healthy living being an important issue worldwide. With so many of these types of products on supermarket shelves, it is essential that manufacturers can distinguish themselves from the rest, not just by taste, but also by the consistency of the product and how easy it is to drink.

Dannon are only too aware of this fact and this is why they invested in Elcometer 2352 AFNOR Viscosity Cups, to provide the perfect quality control tool that ensures the finished drinkable yoghurt is indeed drinkable.

Elcometer AFNOR viscosity cups are made of anodized aluminium and measure the kinematic viscosity, or flow, of the yoghurt, when manufactured and after a period of storage, ensuring the consumer receives it with a palatable consistency each and every time.

Peugeot UK clean up at the car wash

John Adshead – Elcometer UK, discusses the PSA's recent purchase of laboratory test equipment.

Peugeot–Citroën (PSA) paints do more than make the car look attractive. They are complex, highly engineered products that need to meet the strictest specifications. This is why the company have their own Paint Materials Teams to work with suppliers, making sure the paint does what is expected of it.

Peugeot UK have for quite some time, used car wash simulators to evaluate the potential "life-time" performance of their coatings. Their old system became tired and as more technologically advanced coatings are always being developed, Peugeot turned to Elcometer for a replacement.

Elcometer worked with leading car manufacturers to develop the 1730 Car Wash Simulator so that it would be flexible enough to comply with a variety of test methods and procedures. Automotive paint has to be durable and

withstand harmful agents such as ultraviolet rays, moisture, pollution, impacts and scratches. As many Peugeot customers will use a car wash, the Elcometer 1730 Car Wash Simulator is one of the ways that allows these harsh conditions to be tested in controlled, laboratory conditions. During testing, a coated test sample is continuously wetted with a mixture of detergent, water and abrasive powder while being attacked by a rotating car wash brush. After a pre-determined number of rotations, the damage is evaluated by measuring the retained gloss – the more scratches, the lower the gloss level.

This system gives a quantitative and repeatable test result, allowing different paint coatings to be compared accurately. Peugeot can then evaluate which coating will continue to deliver the performance they, as a quality manufacturer, demand.

product of the month

The new range of Elcometer P331 Covermeters.

The range has been designed to meet all of your requirements when measuring rebars in concrete. From simple rebar location to a site survey requiring full data logging and comprehensive report generation, Elcometer's P331 Covermeters and Covermaster® software provide all that you need. For information on our range of Covermeters, or any of our products, please visit our website www.elcometer.com or contact your local Elcometer distributor.

If you have any stories that you would like to see on the front page, drop us a line: editor@elcometer.com

More nanotechnology

Some interesting problems are being solved, as research into the behaviour of small particles is applied in practice. An example of this is a new coating for pipelines that provides both anti-corrosion and heat insulation in a relatively thin layer, using nanotechnology-based materials.

The thick, bulky layers of rock wool or glass-fibre used until now can trap moisture, leading to corrosion of the pipe. So a new 150 microns coating that provides heat insulation and eliminates trapped moisture is an important development.

But does this new technology create new measurement problems, too?

In this case, no. This 3-layer coating can be measured quite simply with a wet film comb and a coating thickness gauge, the same as ‘regular paint’.

Often, terminology of new technology hides the fact that the measurement required is actually quite a simple one that can be achieved using existing gauges.

Floor polish

Splendid floors in office blocks and shopping malls have hundreds of people passing over them. A necessary effort for the maintenance team is to keep them looking good. But often the science of polish is ignored; even easy-to-use formulations require certain conditions.

Many floor polishes are water-bourne. Typically, 80% of the applied wet film will evaporate, leaving the polymers and other components to form a hard, dry film. Unfortunately, there are limits to the ambient conditions that allow this to happen, specified by the manufacturer of the polish.

If the prevailing humidity is high, the water solvent will evaporate only slowly. If a second coat is applied to it, the first one may still contain too much water for the materials to react completely, leaving a hazy look to the surface, which is still soft. This is similar to paint.

The humidity problem can present itself in cold conditions. The floor temperature being too low reduces the rate of evaporation of water. Even dew can form on the cold floor. And if the temperature is below the minimum film-forming temperature, the resulting coating will become powdery very quickly.

Such problems can be avoided if the relative humidity and the surface temperature are measured with an Elcometer 319 Dewmeter before applying the polish.

Taber CS10F – reminder

Alan Jaeneke of Taber Industries repeats a vital message.

The colour of CS10F type IV wheels is brown. If you are still using pink or red ones, replace them.

Reface CS10F wheels with ST-11 stone, not S-11 sandpaper discs or the haze results will be much higher.

ASTM D1044 and ANSI Z26.1 have been reviewed and changes to the procedure are being voted on.

Use a Haze Kit (part no. ST132615) accessory to ensure grit particles are properly removed from the wear path.

Old style type III wheels are still available for a limited time; now known as CS-T3, part number ST132661.

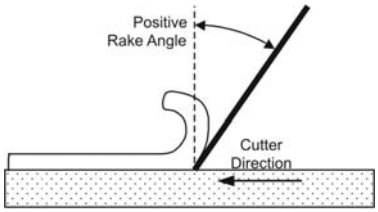
Ensure your instrument is calibrated. The Abraser Calibration Verification Kit (ST132030) can check this.

Please review this information and share it with your people. If there is any doubt, please ask for guidance.

Scratch-cutter angle

The angle of a knife blade or cutter moving along a surface (right to left in the diagrams) is called the Rake Angle. This angle, between the blade or cutter and the perpendicular, can be ‘positive’, ‘negative’ or ‘normal’.

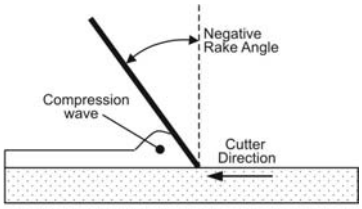
POSITIVE RAKE ANGLE



In the direction of travel, shown by the arrow, the cutter is angled behind the perpendicular to the surface at this point. It cuts the surface from the rest of the material producing a curled chip or shaving.

NEGATIVE RAKE ANGLE

The cutter angle is opposite to the above, sloping ahead of the perpendicular (normal). As it travels along the surface, the cutter produces a compression wave in the material. This delaminates and removes it while pressing some of the material downwards, smearing it.



NORMAL RAKE ANGLE

The cutter is perpendicular (normal) to the material’s surface. Its movement produces a compression wave but without any downwards pressure.

CHOICE OF ANGLE

Materials and coatings react differently, depending on the Rake Angle of the sharp object moving along its surface. The damage that might be done in service can be imitated and analysed in the laboratory using the Elcometer 1535 or 3025 Scratch Tester fitted with different cutters.

Soft concrete

The surface of wet concrete can sometimes set weaker than it should and is therefore unable to stand up to wear and tear. If this is discovered early enough, a layer can be added or the surface can be hardened before significant damage is done.

One feature of concrete is its strength. This is determined by the water-cement ratio, which is normally about 1:2 or less. If too much water is used in the mixture, the result is a weaker structure. Excess water added during mixing will weaken the concrete so it has to be carefully controlled.

More usually, water on the surface of fresh concrete is the cause of the problem. It can come from rain, condensation or dew. If it remains during the curing process, smoothing the surface with a float will push it in, exceeding the desired water-cement ratio, weakening the near surface of the concrete.

Concrete driveways and floors with a weak surface quickly disintegrate to powder and have no weather resistance. A weakened concrete surface can be hardened with chemicals or by coating it with a more durable material, but first, the problem must be identified sooner rather than later.

The Elcometer 181 Concrete Test Hammer, provides the perfect test. It contains a spring-loaded mass, which strikes against a steel plunger touching the surface of the concrete. This mass bounces off it and the rebound distance is shown on a scale; the harder the surface, the greater the rebound.

Inspecting adjacent areas of the same concrete surface with an Elcometer 181 Test Hammer will confirm if the hardness is reasonably consistent. If it is not, remedial action at this stage could save expensive repair and disruption later.

Post-tensioned concrete

Large open areas in multi-floor buildings are now being built using Post-tensioned (PT) Concrete, due to it's strength and comparatively lightweight structure.

Concrete is stronger in compression than in tension, whilst steel is strongest in tension, so the two are combined. Steel tendons of approx. 16mm in diameter are passed through a concrete floor, tension is then applied to the tendons compressing the concrete, then locked in position for the life of the building. This construction allows thinner floors to be built over greater spans without sagging in the middle.

Location of the steel tendons must be precise, as damage to them, by cutting for example, will weaken the entire structure. Usually, they are about 130 mm below the surface, but to obtain the exact location of the PT tendons, a Borehole Probe or a Deep Cover Search Head with an Elcometer 331 Covermeter can be used.

SSPC PA2

"Measurement of Dry Coating Thickness with Magnetic Gages" is one of the most widely used standards from SSPC (Steel Structures Painting Council). As in the previous issue of elconews e-zine, we look at how readings are collected using this method.

We will concentrate on the systematic measurement of coatings, though this standard includes calibration and adjustment methods too (one or two thicknesses on a typical profiled surface).

SSPC PA2 has the concept of a 'spot', which is roughly a 40mm diameter circle. Within this, the probe is placed 3 times in random positions. The average of these 3 readings is a called the 'spot reading'.

The total area of the work is divided into 'inspection areas', each 10m^2 (107 ft^2) and of no particular shape, according to the sampling plan. The average (mean) of 5 spot readings is the dry film thickness (DFT) for that area.

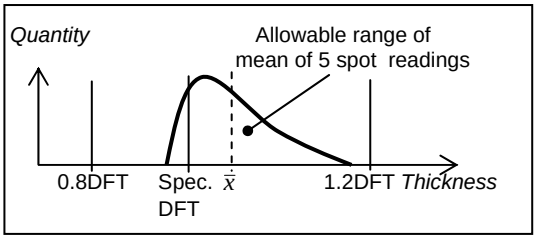
SAMPLING PLAN

TOTAL AREA	INSPECTION AREAS
10m^2 (100 ft^2)	The whole area
Up to 30m^2 (300 ft^2)	Each 10m^2 (100 ft^2)
Up to 100m^2 (1000 ft^2)	3 x 10m^2 (300 ft^2) at random
Above 100m^2 (1000 ft^2)	First 100m^2 (1000 ft^2) as above, then 1 x 10m^2 (100 ft^2) per 100m^2 (1000 ft^2)

PASS

According to SSPC-PA2, the DFT (Dry Film Thickness) of an inspection area is acceptable if the following conditions are met:

- The average spot reading value is at least the Specified DFT or greater.
- A single spot is more than 80% of the Specified DFT.
- A single spot is less than 120% of the Specified DFT.



The thickness of the coating is acceptable if the DFT of an area fits within the curved part of the graph.

There is a provision for rejecting some low readings; consult the standard for details.

Standardisation bodies, such as ASTM, BS, CEN and DIN, hold the copyright to all their publications. Details and parameters may be exchanged during the implementation of a Standard, they say, not otherwise.

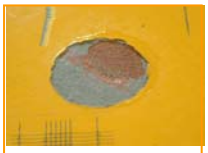
Everyone wanting a Standard must therefore pay for it via the standard bodies websites, so please do not ask us to make copies.

product group focus: adhesion

In this issue, we look at some of the materials that can be measured with a tensile adhesion tester and some of the challenges.

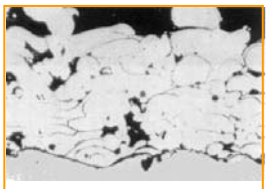
THE CLASSICS

Multi-layer paint on thick metal structures. The test is to identify if the primer is gripping the metal and if the layers have bonded with each other. If one layer has poor cohesion, it will be split apart by this test (picture).



Cohesion failure in intermediate grey layer

Metal-spray (thermally applied metal) coating on thick metal. The substrate must be clean and the spray still hot when it lands on the surface or the layer will easily disbond. Because the coating is porous, the test adhesive must have a high viscosity, or it will penetrate through the layer, possibly to the substrate, giving a higher and inaccurate reading.



A cross section of metal-spray

Coatings on concrete. From waterproof membranes on bridge decks to coatings on factory floors, the material must be bonded to the substrate. A tensile test will usually break the substrate. It is often more convenient to use some of the uncured coating material as the adhesive, to bond the dolly to the test area.

Wet paint and powder coatings on wood-based material for furniture. A good, continuous coating must also grip the substrate. Furniture, domestic and office, will have some impact damage in use and the coating must stay where it is, not delaminate. A tensile test should break the surface of the substrate.

Paint on medium density fibreboard (MDF)

Adhesive for ceramic tiles.
The bond must be stable over time, not only with the substrate (background) but with the tile, too. A standard test method uses 50mm x 50mm square dollies adhered with the test adhesive pulling against a concrete block. The test could also be used when designing the back of ceramic tiles.

Support ring for use with 50x50 dollies when testing tile adhesive

NOT SUITABLE

Tensile adhesion of coated plastic parts is often unsuccessful because of bending and flexing as the force increases. This results in a peeling not a pulling action.

Fixing flexible or thin materials to a stiff metal plate can provide rigidity to perform a test. Of course, the bond to the support must be stronger than the material being tested.

Testing a thin sample fixed to a stiff plate left a 'bubble'.

Materials with a soft or an uneven surface do not provide a stable surface for the tester. This results in a pull that is not at 90 degrees to the axis of the dolly or stub. A base support ring that is available with some models solves this problem. It is a metal disc with a central hole, its large area spreading the reaction force.

An elastic coating cannot be tested with a tensile adhesion tester because it behaves similar to a spring. Under the test area, it absorbs some of the pulling force and stretches, transmitting much less of it to the interface between the coating and the substrate, until the material exceeds its yield point and breaks. Meanwhile, the reaction force is delivered to a spring in compression at each contact point (feet) but these do not balance the central one. And because the Young's Modulus (deflection / force) of the elastic material is different to that of the tester, the combined result is a hopeless mess, best avoided.

VALUES

Adhesion testers were developed over 3 decades and have proven useful to evaluate the properties of many coatings and materials. However, most of the test results that were collected are kept from the public - one reason why a list of typical materials and their adhesion values is not readily available. Because all testers work slightly differently, one model to another, it is dangerous to mix the results or to expect any correlation without a trial.

ASSESSMENT OF PROCESS

The ability to coat structures and ensure the adhesion is adequate is a requirement of some standards. For example, NORSOK 501 requires the bond strength in certain cases to exceed 5, 7 or 9MPa rather than achieve a particular figure *(See Elcometer 109, left)*. In this case, it is not necessary to test to breaking point.

STRENGTH OF ADHESIVE

Various adhesives are available on the market but it is not always obvious how strong they will be when applied to particular surfaces or materials; sometimes there is a bad reaction. Added to that are different ways of preparing the dolly and the test surface. All these may need to be tried.

Remember, an adhesive must be stronger than the coating and the substrate to be tested. The testing of different adhesives and preparation of interfaces is yet another use for a tensile adhesion tester.

The adhesive supplied with the equipment is not always the most suitable for the test. Here are some alternatives: 3M M2000, 3M EC-1386, Loctite 480, Hernon 126, E900S, Araldite Standard and Rapid.

CONCLUSION

There are many aspects to an adhesion test as we have shown. It is certainly an important factor in the development of coatings, the coating process and has uses in controlling production, too.

If you have any comments or questions about adhesion testing, please contact John Podvoiskis, Technical Support Engineer, by email: techsales@elcometer.com.