NANO-9 KOTE
CREATED USING NANOTECHNOLOGY

6-8 England Street
Dandenong VIC 3175
Australia

Tel: +61 3 9768 3277
Fax: +61 3 9768 3986

Durability of Hydrophobic Coatings Measured By Abrasion Resistance

Abstract:

The results of the abrasion testing shows that the coating material from Nanokote significantly outperforms all other competitive products tested, in fact, the Nanokote coating material performs in-line with an industrial quality coating that requires one time application. Exposure to normal cleaning cycle abrasion does not negatively affect the quality of the Nanokote coating. Competitive coatings A to E all differ in performance with the best of the competitor products failing in less than 1000 double abrasion cycles. Competitor B and D appear to be of a different nature to that of products A, C and E. Based on the performance results of this test it appears that products A, C and E all perform in line with being silicon based coatings that produce a slippery surface when applied to glass. These coatings are typically of low durability, all of these coatings fail in less than 500 double abrasion cycles. The test method employed is designed to as best possible mimic the normal cleaning process that is used to remove limescale from glass.

A certificate of analysis with every batch of coating material supplied is an important document and should be requested by Industrial glass companies when evaluating prospective suppliers of these types of coating materials. The document should include an initial contact angle measurement and a contact angle measurement after a designated number of double abrasion cycles. This ensures that the glass company is applying a known quantity when it comes to value added coatings.

Experimental Aim:

To evaluate the abrasion resistance of a range of hydrophobic glass coatings by simulating normal cleaning procedures.

Background:

Easy to clean, hydrophobic coatings have become popular in the glass industry, especially in the shower screen and balustrade markets. The coatings available vary in quality substantially so it is important for OEM glass companies to be aware of what they are purchasing. Hydrophobic coatings were first introduced in the mid 1980's and have gradually been improving over the last 25 years. The basis of the hydrophobic effect can be due to various active components such as fluorinated polymers, resin technology, silicon, siloxanes, and more recently sol-gel technology. As expected, these technologies result in coatings of varying performance, and coatings within a category type can also vary in quality and durability.

There are many tests that can be carried out to gauge the performance of these coating but perhaps the one that is most pertinent to OEM glass companies is the abrasion test. OEM glass companies need to be sure they choose a coating that is the best in the market.

Method:

A method to evaluate the coatings has been based on an American Standard Test Method (ASTM D2486) for evaluating the scrub resistance of wall coatings. This method is slightly modified to substitute a nylon brush for a sponge. A water based abrasive cleaner is used in conjunction with the sponge to simulate the effect of removing scaly calcium and magnesium based residues (limescale) from glass. A pressure per unit area is applied to simulate the pressure that would normally be involved with manually using a sponge to remove scaly deposits on glass. The water based abrasive cleaner is applied to the sponge and the coated glass is exposed to abrasion cycles. In each case glass is coated according to the manufacturer's application instructions and allowed 24 hours to fully cure. Contact angle measurement is used to evaluate the hydrophobic effect of the coating after pre-determined abrasion cycles. A contact angle of less than 70 degrees is considered a failure of the coating to behave as an easy to clean surface.

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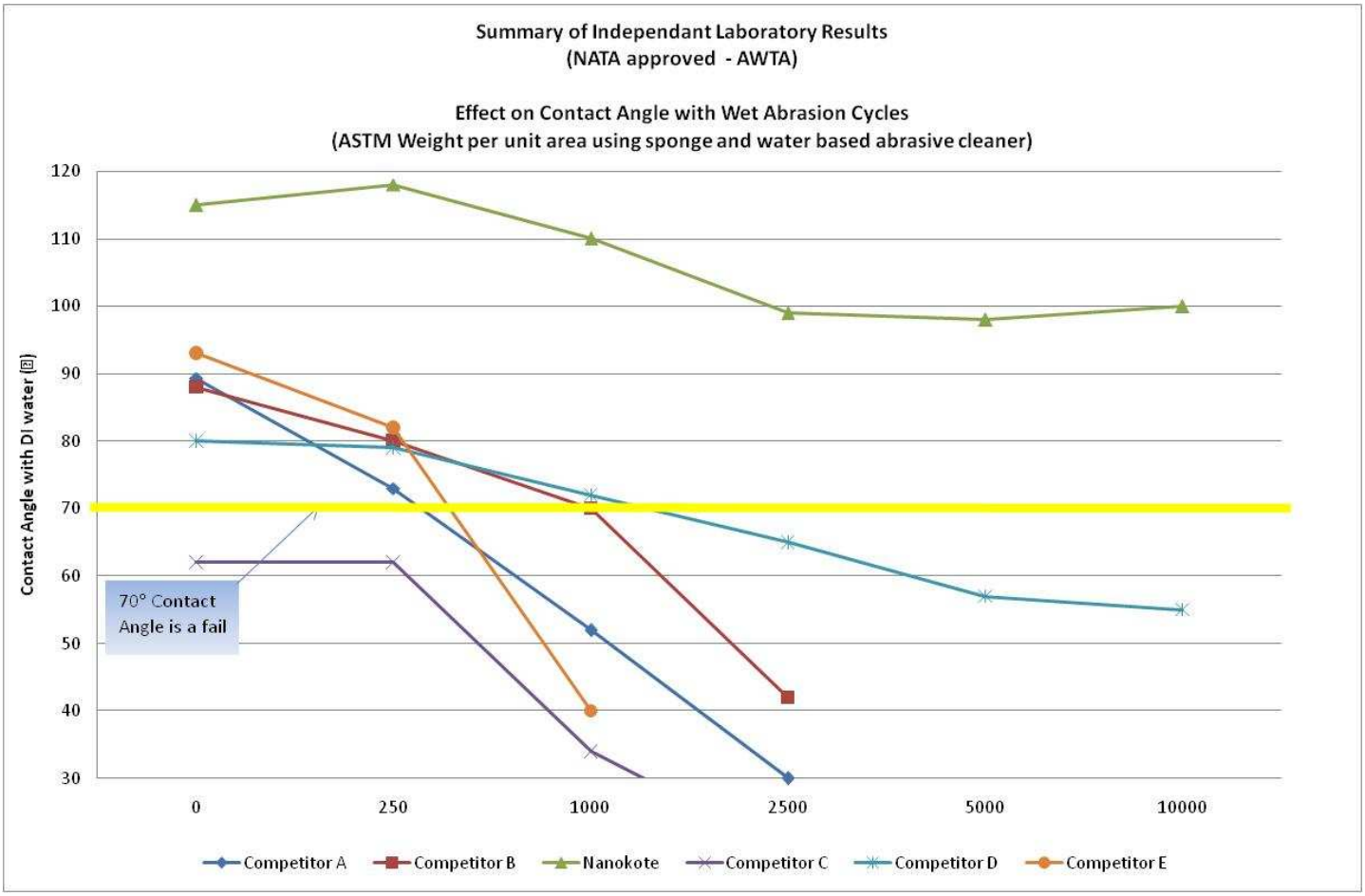
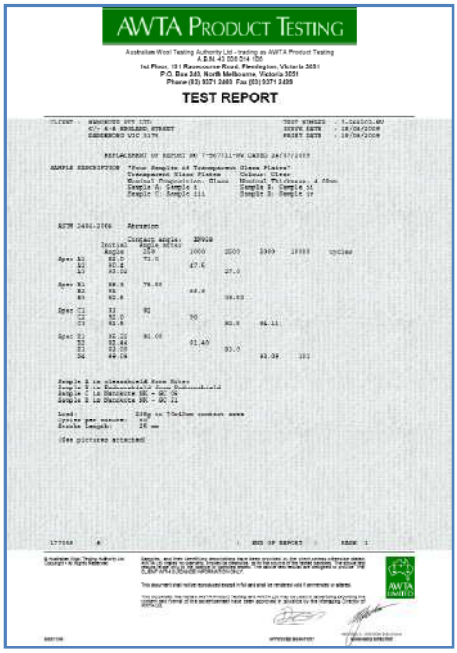


Results & Discussion:



The data shown in this document have been generated by AWTA Product Testing, an independent NATA approved laboratory which has world recognition (www.nata.asn.au).

The results of tests have been illustrated in the graph above. The original data is tabulated in the AWTA Report. For a copy of the original report please contact Nanokote Pty Ltd. Initial contact angle measurements were recorded with droplets approximately 3mm in diameter. Contact angle measurements were conducted again at the following intervals; 250, 1000, 2500, 5000 and 10,000 double abrasion cycles. A contact angle of 70 degrees or less is considered a fail. At contact angles less than 70 degrees the glass surface is not considered to be easy to clean and requires re-coating.

Other than competitor C and the Nanokote product all of the other coatings had initial contact angles between 80 and 94 degrees. Competitor C had less than a 70 Degree initial contact angle which under the criteria for being an easy clean surface fails before exposure to abrasion. The Nanokote coating has an initial contact angle of 115 Degrees.

On exposure to abrasion all competitive products were affected within 250 abrasion cycles with the rate of degradation increasing more rapidly after 250 cycles. Products

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A, C and E all felt slippery when coated which is indicative of a silicon based coating material. These materials have inherently been not resistant to abrasion, which is evident in these test results. The coating material from Nanokote substantially outperformed all competitive products. After 10,000 double abrasion cycles the contact angle on the Nanokote coating material was 100 Degrees.

In each test case the fire side of the glass was the side coated and exposed to the abrasion cycles.

Conclusion:

The results of the abrasion resistance testing shows that the coating material from Nanokote significantly outperforms all competitive products tested. In fact the Nanokote coating material shows little sign of deterioration, even after 10,000 double abrasion cycles. Industrial quality coating materials for application on glass as a hydrophobic coating should be capable of passing 5000 double abrasion cycles. This equated to cleaning once per week over a period of 10 years (10 scrubbing cycles per weekly clean). The test method employed is designed to as best possible mimic the normal cleaning process that is used to remove limescale from glass.

For your information:

Competitor A is Clearshield
Competitor B is Enduroshield
Competitor C is Vitroglaze
Competitor D is ITC - Nanocoat
Competitor E is Nanovations / Nanoshield