Performance Assessment of Building Envelope Interfaces: self-adhering flashings

N. Van Den Bossche[1], A. Janssens, J. Moens & T. Ost

ABSTRACT

The overall performance of a building envelope is mainly related to the performance of the different materials of building components. The performance of those specific components may be very well known in different research area's (thermal properties, acoustics, airtightness, watertightness…), experience points out the weakest link is in fact the interface between those different components.

There are a number of elements that caused a shift in the way we think about building envelope interfaces.

- First of all, an overall increasing life standard causes people to have higher expectations when it comes to newly constructed residential buildings. A few decades ago houses used to be “somewhat warm, somewhat dry and somewhat comfortable” as J. D. Katsaros (Katsaros and Hardman, 2007) puts it. Today people have strict demands and even the slightest mark of water infiltration can give rise to disputes and legal actions.
- Due to an increased attention to environmental issues and the spectacular rise of energy prices governments and individual builders invest in higher insulation levels, more airtight buildings and the use of sustainable solutions.
- In a lot of countries building regulation codes are evolving from prescriptive codes towards performance based standards (Sjöström 1999, Haberecht et al., 1999). That way those standards will make way for expanding the limits of free trade in a globalizing world. The development of a methodology for performance assessment of building products, components and constructions is crucial for the future implementation of performance based standards. Building envelope interfaces cannot be evaluated using the performance criteria of the adjacent building components, so specific research is needed in order to quantify those interfaces in different areas.

As the current building practice in Europe uses more and more self-adhesive flashings there is a major need for performance-based criteria to assess their short- and long-term behavior.

This paper looks into different existing methodologies for artificial aging of samples and offers a state-of-the-art concerning research on self-adhering flashings. Initial experiments seem to contradict some of the found results concerning the performance of different types of adhesives (butyl/modified asphalt). Lab experiments also point out that the interaction between certain adhesives and substrates needs further investigation in order to avoid future water infiltration problems. Three types of self-adhering flashings are tested on four different substrates in lab conditions and after artificial aging to investigate the long-term performance of different flashings. Also the influence of the use of primers is analyzed.

N. Van Den Bossche is Doctoral Researcher; A. Janssens, PhD is a Professor and T. Ost is a Master's student in the Department of Architecture and Urban Planning, Faculty of Engineering, Ghent University, Ghent, Belgium; J. Moens is Visiting Professor at Ghent University and President of Bureau Bouwtechniek, Antwerp, Belgium.

INTRODUCTION

The rain penetration control strategy of building components can be subdivided into three main categories (Straube, 1998):

- Storage systems (an assembly with sufficient storage mass to absorb all rainwater that is not drained or otherwise removed from the outer plane, for example a thick solid masonry wall)
- Perfect barrier systems (also called a face-sealed wall or one-stage system, this one perfect barrier stops all water and is located at or near the outer plane, for example a flat roof or structural glazing)
- Screened-drained systems (also called two-stage systems, where it is assumed that some rain water will penetrate the outer plane that will subsequently be removed by an assembly that provides drainage within the wall)

Most residential buildings in northwestern Europe are constructed with masonry cavity walls, which are based on the screened-drained system and to a lesser extent on a mass storage system. This kind of wall performs very well for the local climate and there are very few problems with regard to the assembly of the wall. In current building practice there is no flashing around the windows, only a water shedding membrane above the windows to divert the water inside the cavity outwards. Most problems concerning water infiltration are situated in high-rise buildings (or buildings in a windy environment with low shelter) and are located at the interfaces between different components, like window to wall, wall to roof, etc. Apparently the interfaces of cavity walls do not posses enough drainage and/or buffering capacity to be watertight under all circumstances. Due to a number of case studies with water ingress around the windows more and more flashings are installed in the window-wall interfaces. This ensures a higher level of security to prevent water ingress, but also has another advantage: in some cases the flashing will also act as airtightness membrane, and thus also reduces the risk on condensation due to exfiltration of humid indoor air. On the other hand one might discuss the primary function of the flashing in this case: does the watertightness ensures the airtightness or is it the other way around? The window-wall interface is usually quite leaky: this will cause relatively large airflow rates when high pressure differences are applied. While screened-drained systems sometimes partially rely on pressure equalization or moderation to be watertight, this function is short-circuited by the large airflow rates at leaky interfaces. The installation of flashings around windows allows a build-up of pressure during static pressure differences. However, this is only one possible explanation for the water infiltration problems. On the other hand the kinetic energy of raindrops, the influence of specific eddies and vortexes around corners or just bad craftsmanship could be the cause of water ingress problems. More research is needed to determine the specific cause.

The flashings around the entire perimeter of windows in masonry cavity walls are a relatively new concept in the current building practice in Europe. In most cases peel-and-stick flexible flashings are used, but there is not enough experience to evaluate the long-term performance of different types of flashings (consists of some sort of top sheet, mostly modified asphalt or butyl rubber adhesive and a release liner). Currently there are no European or Belgian standards to test the durability of those systems, and a literature review reveals that there has not been a lot of independent research on this topic. Hence a research project was started with initial testing in a first phase to analyse different types of artificial aging and to determine the key parameters.

Different types of artificial aging can be distinguished based on what is tested (adhesive only, whole product testing, applied product testing), on the way the accelerated aging is simulated by manipulating one or multiple boundary conditions (relative humidity, temperature, radiation, substrate preparation…) and the way stress is imposed. The boundary conditions can be constant, variable or cyclic, and the imposed stress can also be static or dynamic. In the next section a number of studies found in literature are presented. Although not all studies concern self adhering flashings, the methodology for assessing the long-term performance after artificial aging that is used is of interest for further research.

REVIEW OF MATERIAL TESTING

Zima et al. (2004) did some adhesive only testing (the adhesive was extracted from the flashing by using liquid nitrogen) in order to analyze the behavior of the adhesive under different circumstances: e.g. did the adhesive degrade, become brittle or flow excessively? The specimens were subjected to aging in an oven at 70℃ or in an environmental climate chamber with varying boundary conditions. The evaluation was based on a visual observation of the degree of pooling and it was concluded that certain modified asphalt specimens showed pooling after aging at 70℃.

Katsaros (2005) carried out thermal aging tests on self-adhering flashing products (3 modified asphalt types, 3 butyl types). The samples were applied to bare OSB and put in an air-circulating oven at 70℃ for 14 days. The top sheets of two out of three modified bitumen flashings curled back, exposing the adhesive, whereas one butyl sample showed wrinkles. Whether there is a correlation between the type of adhesive and the behavior of the top sheet is not indicated.

Chang (1997) developed a test method for accelerated humidity conditioning of structural adhesives in order to predict the durability of the adhesive bond. This test method has been designed for adhesives in general, and not specifically for self-adhered flashing (the type of substrate is not indicated, validation has been done on steel substrates). Therefore the proposed method would need further investigation to determine whether it could also be applied to flashings. It is observed that most methods for accelerated aging of adhesives use high temperatures and high relative humidity. Whereas the use of high temperature in accelerated aging conditioning increases the diffusivity of the adhesive, the time required to saturate the specimen is decreased. However, the use of extreme high temperatures (e.g. some types of epoxy adhesives can lose their bulk strength by hydrolysis when immersed in water at 70° to 100℃, which would not occur under normal conditions, Kinloch 1987) to accelerate humidity conditioning raises concerns whether the elevated temperatures also introduce anomalous damage modes. It is reported that failure resulting from long-term exposure to humid conditions tends to be interfacial, thus primarily adhesive in nature, as compared to cohesive failure. A further assumption is made by the author that the presence of moisture at the interface leads to a rather rapid degradation in interfacial strength. Apart from the degree of diffusivity of the adhesive, the water and vapor transport properties of the substrate will also affect the amount of moisture at the interface. In order to eliminate the influence of the substrate and to accelerate diffusion it is suggested that an adhesion test specific to coatings be used, specifically the use of a coating of about 0.1 mm applied to a steel substrate. The thin coating soon reaches an equilibrium humidity state (a matter of hours) simulating long-term exposure to certain humid conditions and can be analyzed using a specific test for the critical strain energy release rate.

Next to Chang, Knox (Knox and Cowling, 2000) also developed a rapid durability test methodology to predict the long-term performance of adhesives without artificial aging: by applying a thin film (0.4mm) on a metal substrate the artificial aging is simulated. These kinds of tests offer a different perspective on artificial aging: perhaps the influence of extreme boundary conditions on the chemical and mechanical properties of the adhesives and adhesive interfaces (that can initiate anomalous damage modes which would not occur during in-use conditions) can be omitted by doing tests on a thin layer of the adhesive. Whether these types of tests are feasible on a wide range of substrates needs further investigation.

REVIEW OF WHOLE PRODUCT TESTING

Katsaros (2005) tested different types of flashings on a number of substrates under different static boundary conditions (temperature of -4℃, 27℃ and 38℃). Three modified asphalt flashing systems and 3 butyl rubber systems where tested on 5 different substrates (OSB, PVC, concrete blocks, steel, fibreglass coated sheathing board) and for each product 5 replicates were tested. The surface treatment of oriented strand board (OSB) was varied and the influence of primer was also analyzed. The author concluded that “for all conditions and products, the use of a primer dramatically improved the adhesion performance”. All products adhered well to strips of PVC and painted steel without primer, whereas when tested at temperatures below freezing all products required primer. Butyl performed better than modified asphalt in a number of conditions: modified asphalt performed as well as or better than butyl only when applied to strips of PVC and painted steel, and especially when tested at low temperature.

Zima et al. (2004) used an Atlas Ci65 Xenon Weather-Ometer to test different window flashing products according to the ASTM Practice for Operating Light-Exposure Apparatus With and

Without Water for Exposure of Nonmetallic Materials (G26). The samples were adhered to rigid vinyl strips and cycled in heat, light, darkness and moisture for 14 weeks. Then the samples were visually observed for degradation, and three-point bend tests were performed on the vinyl strips to determine whether there was any degradation of the vinyl. Three out of four modified asphalt samples showed substantial degradation: the butyl samples did not show any visual signs of degradation. As the different samples also had different types of top sheets it is unclear what parameter was dominant: the type of adhesive or type of top sheet. The test results on the modulus of the rigid vinyl were too scattered to determine if the type of adhesive affected the results.

Identical samples were also tested for durability in adhesion during a 180° peel test (AAMA 800, 1992). One set aged in a 70℃ oven for two wee ks, a second set aged at room temperature during one week and then was immersed in distilled water for one week: both results were compared to a reference sample set that was kept at room temperature for two weeks. The aging in the 70℃ oven increased the peel strength of all samples compared to the reference values obtained from exposure to ambient laboratory conditions. The influence of the water exposure test mainly depended on the type of substrate to which the substrate was adhered. After aging, the modified asphalt samples performed very poorly on OSB, but when placed on SBPO housewrap and vinyl they performed as well as the reference sample set. The butyl samples placed on OSB also performed less well than the reference sample set, but not as poorly as the modified asphalt samples. The peel strength of butyl flashing on SBPO housewrap and vinyl was even higher after the water exposure test. The results from tests on the use of primers indicated that 'all primers substantially increased the adhesion of flashing product B2 (multi-component polyethylene top sheet with butyl adhesive) to all of the building substrates'. On the other hand, the results from the use of one primer on the B2 specimen show that the primer has a negative effect on the adhesion on SBPO housewrap.

T. Ackermann (2007) has done research on the long-term performance of adhesive tapes used for sealing airtightness membranes. Eight (8) tapes from different manufacturers were tested on 7 different substrates (concrete, plaster, brickwork, aerated concrete, OSB, wood and plywood). Standard 180° peel tests were conducted as well as an artificial aging test that subjected samples to static and dynamic stress. During the static test the specimen was placed in a climate chamber at 23℃ and 50% RH, adhered to a substrate to simulate a peel test and a weight of 0.5 kg was applied to a tape of 25mm width (weight was deduced from the German building code for wind loads on buildings 8-20m high). The dynamic test was done within the same boundary conditions, but the weight was applied cyclically: the different specimens could be compared by counting the number of cycles to tape failure. This number may occur between 50 and over 10000 cycles depending on the tapes being tested. Looking at the total time the tape was stressed, it appeared that some tapes performed better when subjected to static and constant loading, while others performed better when under dynamic stress loads. The peel test was also completed on tapes subjected to the following boundary conditions: 1. Reference (23℃ - 50% RH - 48h); 2. Cold climate (-5℃ - 85% RH - 24h); 3. Static 1 (65℃ – 80% RH – 60/180/220 days); 4. Stat ic 2 (100℃ – 60/120/168 days); 5. Alternating cycle (12h cycle: 6h at 5℃, 6h at 55℃: both at 80 % RH for 60/180/280 days). It was concluded that it was very difficult to correlate the different aging techniques with respect to different sample products. The influence of the length of the tests was also very ambiguous and analysis showed that no general conclusions could be drawn. For example: sometimes the results showed that peel strength rose after aging in one substrate and decreased for another, whereas if the aging period was doubled an opposite effect might occur. More research needs to be done to correlate the artificial aging to the long-term exposure in a real environment.

Dorin (2006) stresses the importance of correct use and adequate selection of building products. He concludes "The installation methods as well as each part of the installation: the flashing, the WRB (weather resistive barrier), any tape used, the sealant, and fasteners, all contribute to the success or failure of the wall assembly. We know that many products work when tested, but observation show that their integration is very important."

Weston (2002) used thermal cycling tests on whole window to wall interface mock-ups to test the long-term durability of window installation. Wall specimens were subjected to seven days of a repeated 6-hour temperature cycle from -18℃ to 71° C (tested at 82℃, and in accordance with AAMA default recommendations, the vinyl windows showed severe damage). After the aging cycles the water intrusion during tests increased and leakage occurred sooner and at lower pressures, on the other hand the primary points of leakage remained the same. The emphasis of this research was put on the overall concept of the flashing with regard to the bottom corners of windows (where damage is most commonly seen) and the area around curved, arched or round-top windows where it is difficult to install the standard flashing materials. That way the results are only an indication of the achievable level of performance for different flashing configurations.

Lacasse et al. (2003, 2007) has investigated the behavior of walls and wall-window interfaces with the dynamic wind and wall test facility: the effectiveness of two approaches to window installation are tested, analyzed and discussed. Though the long-term performance of the flashing solutions was not evaluated, it offers a very useful methodology for overall testing of building components.

Canada Mortgage and Housing Corporation – (CMHC, 2004) has completed research on the adhesion of air barriers, and one of the conclusions derived from the test results was that the tensile adhesion of the membrane did not necessarily correlate with the results obtained for peel-resistance. Furthermore the peel resistance of self-adhesive sheet membranes with solvent-based primers decreased over a 60-day period, the decreases ranging by as much as 19% to 63%, whereas the resistance of self-adhesive sheet membranes with water-based primers increased over the same period by as much as 14% up to 97%. Even more important, the conclusions state "It did not appear that exposure to a given control variable had a similar effect on all membranes, or all membranes within a particular membrane class (self-adhesive, torch-applied, etc.), or even an individual membrane. The effect of each of the three conditioning cycles, low-temperature, high temperature/high-humidity, and saturation, on tensile adhesion and peel resistance was generally specific to the combination of membrane, primer, and substrate."

In order to benchmark new products available on the market a testing methodology should be developed that can ensure that these components can perform adequately over the long-term. The literature review shows there is no uniformity in the tests at all: not in the way the materials are tested, not in the way artificial aging is simulated, and certainly not in the results of the experiments. The question whether the shear-resistance and the peel-resistance are correlated remains inconclusive. The influence of the primer and the way it is applied is unclear. The in-situ aging of membranes is simulated by subjecting test samples to extreme temperatures, high relative humidities or water, cyclical effects, static or dynamic tensile loads… The different artificial aging methods do not relate to each other, and are not validated with in-situ experiments. A number of aging techniques enhanced the adhesion on certain substrates, while lowering the adhesion on other substrates. The influence of aging depends on the type of adhesive, substrate and primer, so no general methodology to test any sample is currently within reach.

EXPERIMENTS

Introduction

Nowadays contractors want to cut back on working hours and thus replace the currently widely used, but labor intensive water shedding membranes, located behind the brick cladding with the use of self-adhered membranes and flashing products. Today there are no applicable European building standards to test the long-term performance of self-adhered membranes typically used in façade construction. The Belgian Board of Agrément in Building Construction (UBAtc/BUtgb[2]) has developed a guideline for a voluntary performance assessment for these types of products (BUtgb, 2007). Although a number of characteristics can be tested and certified, focus is made on the manner in which one evaluates the long-term performance of the adhesion of the membranes to different types of substrates. The performance requirements given in the Belgian guideline indicate that the adhesive shear strength should be at least 100N for a 50-mm wide sample (testing according to prEN 12317-2:2000). The artificial aging of the samples is done by immersing them in water at 60℃ for 7 days: thereafter the shear strength should still be at least 100N/50mm and, additionally, should not have reduced by more than 50% as compared to the initial adhesive shear strength.

Flashing sample preparation

In these preliminary experiments the behavior of three products is analyzed. The first two products are butyl based and have an EPDM top sheet (thickness 1.2 mm). These two products are produced by the same manufacturer: the only difference is the surface area that is covered with adhesive. The first product (code: SA) has the adhesive applied over the entire surface, whereas the second (code SAf) only has adhesive on a strip. However, during testing the surface area used for adhesion was the same. The third product (code: AQ) has modified asphalt adhesive placed on a thin aluminum foil top sheet. The first two products have a certification which states that they comply with the voluntary performance assessment: the third product is not certified. All product samples were cut into specimens of 50-mm wide by 300-mm long: in all instances the adhesion surface area was 50-mm by 50-mm. Additionally, all products were installed according to the manufacturers specifications:

use of primers, substrate preparation, flashing preparation, interval between application of primer and flashing, and other similar installation requirements.

Substrate preparation

The adhesion of the flashings was tested on four typical materials that are widely used in Belgian building practice: bricks, aerated concrete, untreated wood and anodised aluminum window profiles. Brickwork is the most common construction material: the samples were purchased from a contractor supply yard, together with the aerated concrete and untreated softwood. These products were wiped clean: the anodized aluminum was cleaned to remove any grease form the cutting process. All products were conditioned at least 24 hours at ambient lab temperature and relative humidity before testing. The manufacturers specifications stated that a primer was required on porous materials, and the primer should be applied 30 min prior to flashing installation. The flashing was installed with a roller that was rolled back and forth across each specimen. The European standard EN13217-2 requires that all samples be conditioned (23 ± 2℃, 50 ± 5% RH) at least two hours before testing.

Experimental Method

The shear tests were performed on a calibrated Instron tensile testing machine at a constant crosshead speed of 100 ± 10mm/min at ambient laboratory conditions (21-25℃ – 30-70% RH). Each sample has five replicates, the reported result is the average of the measured maximum stress. Next to the average value the standard deviation and coefficient of variation (standard deviation divided by the average value) are used to compare the performance of the samples. As two independent variables (membrane type and substrate) determine the dependent variable (shear strength) a variation analysis was used to compare different combinations (ANOVA with post-hoc test in SPSS software). The effect of the primer and aging is evaluated using a standard student two-sample t-test to determine whether or not there is a significant difference between results.

Damage mode

The adhesive shear strength of the specimen depends on the cohesive strength of the adhesive, and the degree of adhesion between the adhesive and the substrate on one side, and the adhesive and the top sheet on the other. The surface tension of the substrate is an important parameter in ensuring a durable and strong adhesion: if the surface tension of the adhesive is smaller than the surface tension of the substrate there is a reasonable chance for a good adhesion (Maas, 2004). Once the self-adhering membrane is applied to a substrate five different failure mechanisms can be distinguished. These mechanisms will be used to discuss the results of the experiments.

1. If the top sheet tears, this only means that the strength of the top sheet is lower than the adhesion (Fig. 1: modified asphalt sample on primed brick)
2. The adhesion between the top sheet and the adhesive fails: most of the adhesive remains on the substrate
3. There is cohesive failure of the adhesive: a limited quantity of adhesive is left on the substrate (Fig. 2: butyl sample on primed aerated concrete)
4. Adhesive failure between the adhesive and the substrate: almost no adhesive is left on the substrate (Fig. 3: modified asphalt sample on untreated wood without primer)
5. There is internal failure in the substrate: a piece of the substrate is torn away from the rest of the substrate.

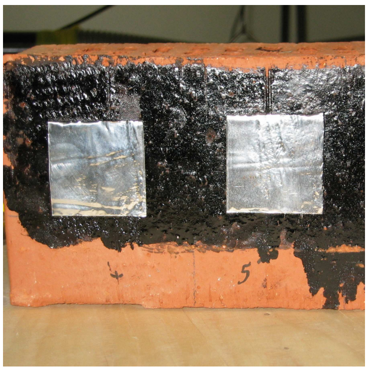

Fig.1 Top sheet fails

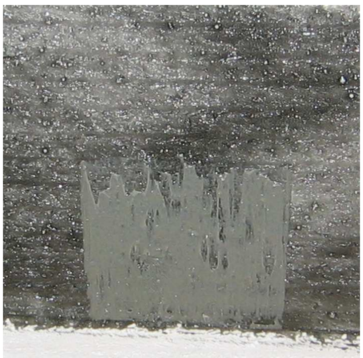

Fig.2 Cohesive failure

Fig.3 Adhesive failure

Test Results

Three samples were tested on four different substrates to compare the performance after aging to the initial values. Fig. 4 shows the results of those experiments: the colored bar indicates the average value out of five replicates: the black dashes indicate the highest and lowest measured values.

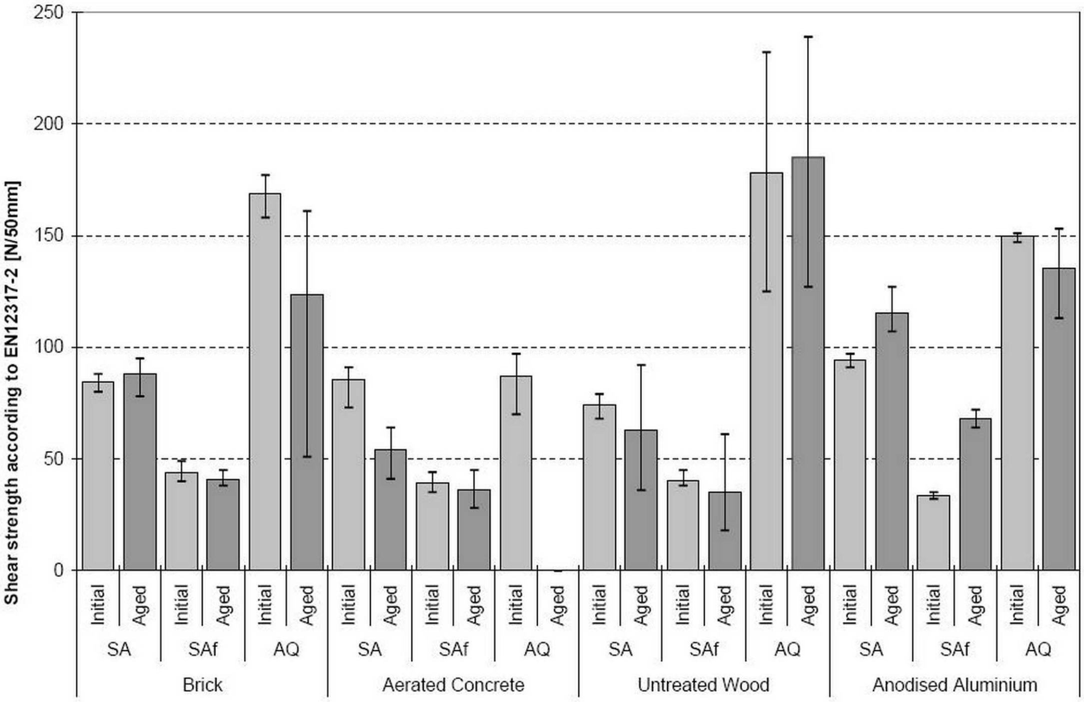

Fig. 4 Shear strength of three samples on four substrates: lab conditions and artificially aged

The adhesive shear strength to bricks shows a clear distinction between the different samples: the modified asphalt sample (AQ) performs remarkably better than the butyl types (SA, SAf). Only the modified asphalt reaches the minimum criterion of 100N/50mm, both in initial conditions as after the artificial aging in water. It is also worth noting that the SA and the SAf samples perform quite differently, the results of the other experiments confirm this. According to the manufacturer the same butyl adhesive is used, but the way it is applied to the top sheet differs and therefore there is a negligible difference in the production process. However, this little change appears to have an important influence on the overall adhesive performance. On top, as this is officially the same product, only one material needed to be tested for certification of both. The butyl samples showed cohesive failure of the adhesive, whereas the modified asphalt failed at the interface between the adhesive and the substrate (but in two out of five replicates after aging the aluminum top sheet broke, Fig. 1). The immersion in water does not affect the performance of the butyl adhesive but the modified bitumen performs less well and the results show more scatter.

None of the samples adhered to the aerated concrete fulfil the requirements for certification. The aging had some influence on the butyl adhesives (lower average value, higher standard deviation), but the results for the modified asphalt are more evident: after one week immersion in water at 60℃ four out of five samples were detache d from the substrate (the fifth sample had a shear strength of 99N/50mm, this is excluded from the chart). The manufacturer's guidelines did not exclude this material from the application range. All samples showed adhesive failure before and after aging, only the SA sample shifted towards cohesive failure after the aging process (Fig. 2). Apparently the migration of water through the porous concrete affected the properties of the adhesive causing it to fail prematurely cohesive. This phenomenon is not reported during tests on other substrates.

The modified asphalt sample was again the only one that had a shear strength above 100N/mm before and after aging on an untreated wood surface. The results of the butyl samples are in the same magnitude as of the brick and aerated concrete substrates. Both types showed very little variation initially, and very high variation coefficients after aging (standard deviation divided by the average values is 36% and 46%). The modified asphalt type reaches very high tensile strengths but also had a large variation in results. The failure mechanisms are the same as the ones recorded on bricks: the butyl types fail cohesively, the modified asphalt type fails adhesively (Fig. 3).

The experiments completed on anodized aluminum show the smallest degree in variation of results: this apparently confirms the AAMA philosophy to test on aluminum to acquire reproducible results. Fig. 4 also shows the performance of both butyl samples significantly improves after aging. All products showed adhesive failure at initial and aged conditions.

We can conclude that, although the criterion for certification is never achieved, the SA – flashing performs equally on all substrates. The same conclusion is valid for the SAf flashing product but the shear strength is even lower. The modified asphalt type is the only flashing product that fulfils the certification requirement, although it fails when placed on aerated concrete, especially after aging.

Primers

The influence of the use of primer on porous materials was also evaluated. The substrates where primer was applied were treated the same way as those without primer. The results of the initial tests are shown in Fig. 5. Again the colored bar indicates the average value out of five replicates, black dashes indicate the highest and lowest measured values and P stands for 'primer', WP stands for 'without primer'.

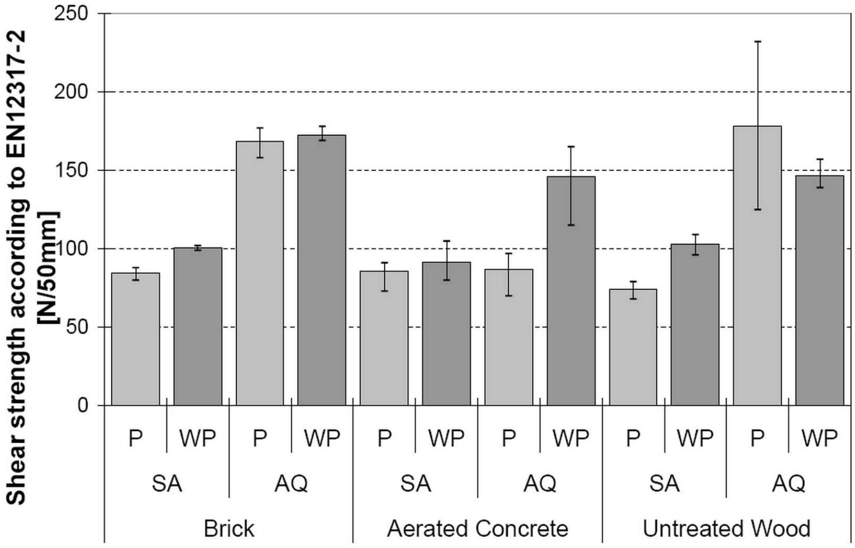

Fig.5 Influence of primer on shear strength

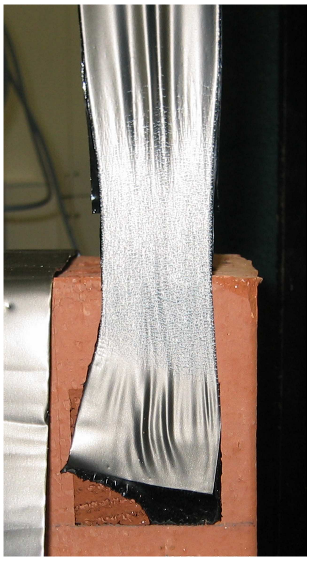

Fig.6 Adhesive failure

First of all the results show that the use of primer does not always have a beneficial effect on the adhesive performance. In almost all situations the sample without primer had higher adhesive shear strength than the one with primer. The primers used were the ones recommended by the manufacturers and the application was done in accordance with all specifications and guidelines. The flashing was installed 30min after the primer was applied, and the sample was tested two hours later. The only instance where samples without primer performed significantly worse than those with primer was the case of a modified asphalt flashing (AQ) applied to an untreated wood substrate. On the other hand, the butyl sample (SA) performed significantly better without primer on untreated wood. Another striking result is the fact that in a lot of cases the use of primer heightens the coefficient of variation: one would expect that the use of primer would introduce more homogeneity in the test results. Maybe the testing methodology does not give the primer enough time to do its job and a longer curing period is necessary? Or the beneficial influence of primer only becomes apparent after a certain time of exposure to in situ conditions? Even the installation of the primer could be applicator dependant and add another degree of uncertainty in the surface preparation which is of course a crucial aspect to achieve adequate adhesion. Such suppositions need further investigation to either eliminate or validate the possibilities. If however, these explanations are not substantiated the conclusion should be that the use of primer should be limited to use only in certain cases depending on the type of substrate and in-use conditions, such as, e.g., state of the substrate surface, outdoor temperatures, and other phenomena related to ensuring adequate adhesion of the flashing.

DISCUSSION AND CONCLUSIONS

The use of self-adhering flashings has risen in current European building practice due to requirement for higher performance standards, stricter energy regulations, as well as the higher expectations of building owners. As more performance based building codes are introduced to the construction sector there is a major need for the development of performance assessment methodologies for new building products to verify and thus ensure that these components can perform adequately over the long-term. A literature review has revealed that the research on some of these products, in particular those relating to window flashing, is not extensive. As well, there is much that should be reviewed in respect to the test methodology and the use of artificial aging to assess their long-term performance.

Preliminary experiments on self-adhered flashings reported in this paper seem to contradict previous derived by others. Nonetheless, results from this work show that, overall, the modified asphalt samples performed better than the butyl-based samples. The use of primer was beneficial in one case and adverse in three other cases, whereas for the other two samples, it did not make a significant difference according to the results derived from statistical tests. Although these tests were performed on three samples and four substrates (150 experiments) these results cannot be used to obtain general conclusions regarding their applicability in service: they are useful in highlighting that more research is clearly needed. First of all, a general accepted and scientifically based artificial aging methodology should be developed to predict their long-term performance: the methodology should necessarily be based on real in situ conditions to which the flashings will be subjected to during their lifetime. As long as the chemical behavior of the adhesives and related interfaces is not fully understood it is very difficult to introduce artificial aging processes that use extreme boundary conditions because they could introduce anomalous damage modes.

Secondly, in order to certify these products, clear-cut performance criteria need to be developed: what initial and residual strength is needed when the level of exposure of the building is taken into account? Furthermore it can be concluded that the use of self-adhering flashings should be limited to those substrates and conditions that have been thoroughly tested.

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