

Tread with Caution: This month's tech article hopefully highlights the need to stay focused on the real issues that matter when installing mosaics, proper installation procedures and the right adhesive selection. The current argument surrounding mesh backed or mounted mosaics should be kept in proper proportion and not allowed to overshadow the real issues. However when selecting a mesh backed mosaic there is no doubt you should **tread with caution** to insure you get a mesh that leaves at least 90% of clean tile surface to be bonded.

Technical Article: Written by Scott Worthington.

Mesh backed mosaics: unsuitable for swimming pools?

Mesh backed mosaics (both glass and fully vitrified) were introduced to improve the ease and quality of installation over the more conventional paper faced versions. The main advantages are; tradesman can see what they are installing; and the important grouting process is more accurate than paper faced versions that suffer from excess adhesive being squeezed into the joint. This creates partially filled, uneven joints negatively impacting hydration (also colour development of pigmented grout) resulting in potentially weaker grout joints overall. Over the last two years there has been an ever-increasing call for mesh backed or mounted mosaics to be banned from being installed in continuously wet areas such as swimming pools. The call is for only the paper faced versions to be used in these circumstances. Even several of the world's leading adhesive and mosaic manufacturers have added their voice to this call. The argument centres on the use of the mesh and more specifically the type of adhesive used to fix the mesh that apparently frequently fails in continuously wet environments causing the mosaics to de-bond. However I believe this stance is too simplistic and overlooks the more important issues of proper adhesive selection and installation technique, which when ignored will create the same problems even with the reportedly superior paper faced versions.

There is no doubt that over the some 25 years I have been in the tile industry mosaics in swimming pools have represented a disproportionate number of failures in overall industry statistics. However I do not think it is the mesh backing that is the central cause of this as is proposed by a growing number of people in the industry, it is rather a number of issues each of which needs to be confronted.

The first thing to investigate is the mesh itself. Mesh backing or the use of paper on the face of mosaics is simply a method to transport the individual tiles on to the surface. In the days of my grandfather (a master tiler) mosaics were used much more extensively than today, as they were the equivalent of contemporary porcelain. Hence they were installed on walls, floors,

interior and exterior, residential and commercial installations. They were predominantly paper faced (as mesh backed were relatively new) but mesh was becoming more common. However there were very few problems and failures associated with either mounting system. Why is this so? Perhaps the mesh was not adhered with an infamous water based adhesive? No, some were some were not. The reason I believe is more to do with the type of construction and installation method that was predominant at the time. Lightweight construction was almost unheard of. Instead mosaics and tiles were installed over thick beds or renders (themselves over concrete slab or block construction) using thick conventional cement mortar bed installation techniques. This resulted in minimal substrate movement and almost total coverage and full bedding of the mosaic. Swimming pools were no exception with my grandfather successfully installing glass as well as fully vitrified mosaics in a number of commercial swimming pools both with paper faced and mesh mounting systems. The problems first really surfaced when lightweight construction methods and the resulting lightweight thin-set or adhesive techniques for installing tile and stone were introduced. These new systems had huge advantages but also had a dark side if not implemented correctly. Mosaics, especially mesh backed, were a casualty of this system exaggerated more in the harsh environment of a swimming pool. There are a number of reasons for this as well as solutions so let's look at these.

- 1. The environment of a swimming pool is a harsh one to say the least.** However if you investigate where most of the mosaic failures occur it is on the water line. This can be attributed partly to the high number of mosaics that are only installed at water line level. However it does not explain why the largest numbers of failures on fully tiled pools also occur at the water line. What does explain this fact is that the waterline is the most extreme environment in the pool as far as bonding tile is concerned. It is the area of the pool that undergoes the most extreme change in thermal and moisture expansion, as it is both wet and dry with the change from one to the other often occurring in a split second. With the advent of lighter weight pool construction and thin-set adhesive techniques the tolerance to get the adhesion right in this high load environment is greatly reduced regardless of the mounting system of the glass mosaic.
- 2. Mesh backed mosaics make up a disproportionate number of mosaic de-bonding failures.** This is certainly true in today's market. But they are also the most commonly produced and installed mounting system so does their somewhat infamous statistical history make them the cause of all the problems? Not in my opinion because the largest number of mesh backed mosaic installations are actually successful. The first thing to recognize about mesh-mounted mosaics is that not all systems are created equal. Most countries have adopted a standard for the minimum amount of adhesive coverage on the back of tile and stone. The Australian/New Zealand standard is amongst the most stringent requiring a minimum coverage of 90%. So the first thing a mesh system must do is leave at least 90% of the tile surface clean to be adhered as seen in *fig 1*. Many of the mesh systems I have encountered do this. However some manufacturers do not and these systems will create problems especially in an environment such as a pool. The second thing to look for is the amount of glue used to bond the mesh to the tile. This is a completely different question than the one posed by the opponents of mesh backing of whether the glue is water based or not. In my opinion whether it is water based or

not is irrelevant as far as adhesion to the substrate is concerned because it is only there to transport the tile and not hold it in place long term. What is relevant is how much glue has been used and if it reduces the amount of clean tile surface to less than the required 90% as seen in *fig 2*.

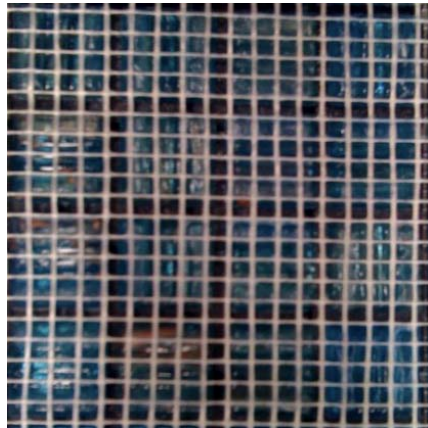


Fig 1

By calculation this mesh backed glass mosaic by Spanish glass mosaic manufacturer Onix has 95% clean tile surface free of either mesh or adhesive.

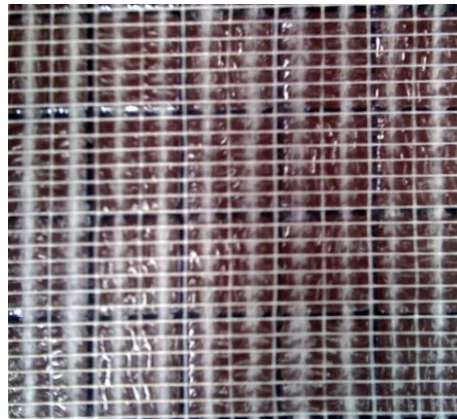


Fig 2

Additional strands of mesh and also excessive use of adhesive to hold the mesh in place have reduced the surface area of clean tile to less than 75%

So the bottom line is that not all mesh mounted or backed mosaics are created equal and some should not be used in a harsh environment such as a swimming pool but this is far short of condemning all mesh-backed systems for this use.

- 3. Adhesives selection and implementation** play the biggest role in creating a successful mosaic installation especially in the harsh environment of a swimming pool. Mosaics, especially glass mosaics, have an extremely dense and relatively smooth surface to bond to making the use of high polymer modified adhesives a must, especially with the often lightweight contemporary design of a swimming pool. Think of glass mosaic like porcelain and you get the idea of the type of surface you are trying to bond to. The photo below, *fig 3*, is a microscopic view of how a polymer modified adhesive bonds to a porcelain surface. Most importantly it is the polymer that is doing much of the work creating an adhesive bond as well as enhancing any

mechanical bond that may be achieved with such a dense smooth surface. This clearly demonstrates the benefits of modifying cement with polymers to create high bond strength to dense surfaces like porcelain and mosaic as well as highlighting the fact that using the wrong adhesive can end in bonding failure. It must also be noted that polymer modified adhesives are also more chemical resistant than conventional unmodified adhesives, important in the harsh chemical environment of a pool.

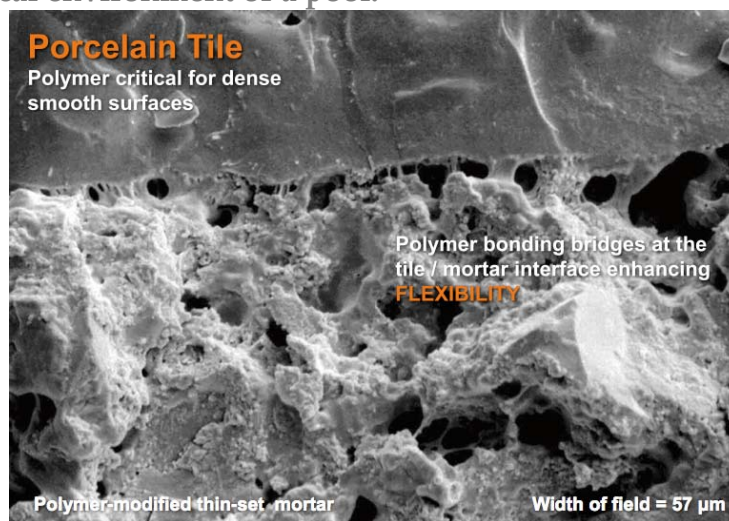


Fig 3

If adhesive selection is important then installation technique is equally important. The first thing often missing in proper technique is the wetting of the substrate and tile surface with adhesive. This is done by applying a tight thin skim coat of adhesive to both surfaces using the flat side of the trowel. A scrapping motion and noise should be heard as the adhesive is tightly applied to each surface. Then and only then should the main body of the adhesive be applied to the substrate with the correct notched trowel (5 x 5 mm V notch is recommended for mosaics up to 5 x 5 cm). The right sized trowel will insure the correct amount of adhesive coverage, critical for a successful job. It also insures there is sufficient adhesive to lightly encapsulate the thin sides of the tile as adhesive should not only contact the bottom of the mosaic but should also partially bond the edges still leaving enough room for an evenly gauged application of grout. Add in the use of a beating block to fully bed the mosaic sheets and you have the installation techniques required for a successful installation. It is the issues of adhesive selection, proper technique and implementation that are often overlooked or carried out incorrectly that are invariably the reasons for mosaic failures in pools rather than the type of mounting system.

4. **Other factors** can of course cause failures as well as contribute to success over and above adhesive selection and proper implementation. For example the selection of the right grout (polymer modified) and even sealing the grout (only applicable to tiles on or above the waterline as sealers will not endure the high water pressure when continuously immersed) can help by reducing water absorption and hence the stress of moisture expansion as well as

improving chemical resistance. However these contribute to the success of a job rather than being the cause of failure. It is factors such as the correct placement and installation of expansion and control joints, correct cure and preparation of the substrate and even issues like the correct sequence and timing of filling the pool that help determine the success or failure of the installation.

In summary in my opinion the mesh-backed system for mounting mosaics and glass mosaics offers the installer advantages over the paper-faced system. There is no doubt that some mesh systems are not conducive to creating a good bond (such as that shown in *fig 2*). However I don't believe this leads to the conclusion that all mesh-backed mosaics should not be used in continuously wet areas such as swimming pools. This I think is a dangerous conclusion because it simply helps one to overlook the main reasons for the failures, namely poor adhesive selection and installation technique. The industry should focus on these important issues. With a good mesh system, suitable adhesive used with proper care and technique, a mesh-mounted mosaic will perform just as well as a paper-faced version even in an environment like a swimming pool. The advent and growing use of the newer PVC spot mounted system may ultimately render this whole issue of mesh backed mosaics in continuously wet areas redundant. However even this system has some current problems the main one being that not all mosaics (especially some of the glass mosaics) can be mounted this way. If you add in my own concerns, that the PVC may create a similar problem with grout that you have when plastic spacers are not removed, mesh mounted mosaics may be around for some time to come. Most importantly regardless of the mounting system, proper adhesive selection and installation design and technique should be the main issues of our focus.

Onix totally guarantee the use of their mesh backed mosaics in swimming pools if proper installation methods are followed.

Points for selling Aqua Mix Products:

A short note regarding the use of sealers in swimming pools – other than some benefits that come from sealing the grout around the waterline of a pool, sealers will not function properly long term in a pool when fully immersed and therefore offer no long term protection. The trick here is to focus on specifying the right Custom adhesive and grout.

