



TECHNICAL BULLETIN – TB228

EFFECTS OF ALKALINE-CONTAINING MATERIALS ON GLASS MESH-BACKED TILES

AUGUST 2024

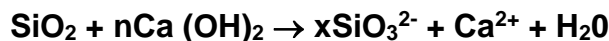
INTRODUCTION & SCOPE

Recent trends are to install either very thin porcelain tiles or structurally unstable stone. This has led to the introduction of tiles which have glass mesh or woven matting bonded to the tile rear face.

In some cases, the mesh is fully embedded in the resin that holds the mesh in place. There are, however, cases where the resin adhesive sits between the mesh and the tile back face. In this case the glass mesh is then exposed to the ceramic tile adhesive when the tiles are bonded. This bulletin examines potential decomposition of the glass mesh due to alkaline attack from cement-based tile adhesives. It also examines subsequent problems with bonding due to decomposition of the backing, and a reduction in durability due to loss of mechanical reinforcement.

WHAT HAPPENS

Standard glass mesh is not resistant to alkaline material such as the lime present in cement-based adhesives. Reaction of the lime with the glass mesh in the presence of moisture causes the glass mesh to break down over time. The reaction can be characterised by the below chemical equation where Calcium Hydroxide is generated by the reaction of cement with water. It then reacts with the glass mesh (SiO_2).



The alkaline material attacks the glass by de-polymerisation and leaches the silicates out into solution. The result is weakening of the glass mesh and fracture of the strands.

As the glass mesh breaks down it increases the potential for damage to the reinforcement and a higher risk of mechanical damage (movement or impact from walking). The other potential issue is development of reaction materials at the interface which are weaker than the original tile adhesive. This increases the risk of de-bonding under tile stress (e.g., thermal movements, building movement, wind loading).



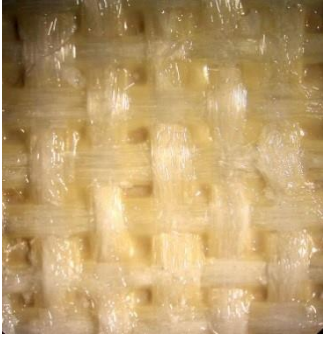
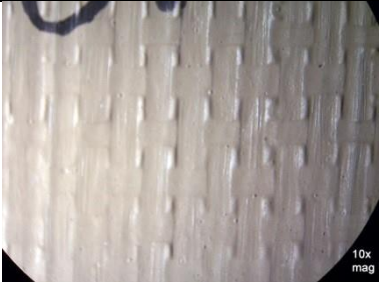
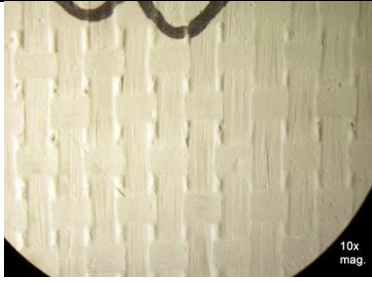
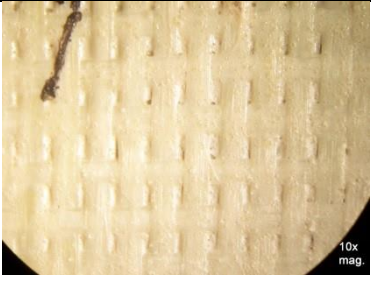

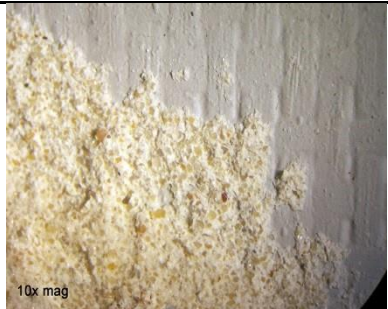
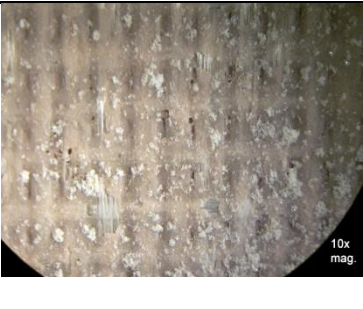
A trial was performed with a sample of mesh backed tile immersed in lime water (pH 12.4) and the results can be seen on the next page.

SOLUTIONS

The tile suppliers need to use a glass mesh that is resistant to alkaline attack. Installers can, however, maximise long term performance by using:

- Non-cement-based adhesives such as epoxy adhesives
- Specialised rapid cure cement-based adhesives with reduced alkalinity effect (e.g., ARDEX S28 and ARDEX X32),
- A primer / seal coat can be applied to the back face of the mesh to protect it prior to the use of cement-based adhesives (ARDEX WPM300, ARDEX WPM368 barriers or ARDEX P9 primer),

Effective control of moisture behind the tiles can inhibit alkali movement and subsequent degradation of the glass mesh.

		
<p>Figure 1. Fig 1. Shows the rear face of a glass mesh backed porcelain tile. Control material untested & magnified 6.4x.</p>	<p>Figure 2. Fig 2. Shows the rear face of a glass mesh backed porcelain tile. Material immersed in tap water for 9 months magnified 6.4x.</p>	<p>Figure 3. Fig 3. Shows the rear face of a glass mesh backed porcelain tile. Material exposed to lime water for 9 months magnified 6.4x.</p>
		
<p>Figure 4. Back face of mesh sealed with WPM368 after 4 months immersion in lime water.</p>	<p>Figure 5. Back face of mesh sealed with WPM300 after 4 months immersion in lime water.</p>	<p>Figure 6. Back face of mesh sealed with P9 after 4 months immersion in lime water.</p>
		
<p>Figure 7. Back face of mesh sealed with WPM368 and then bonded with a C class non-F rated adhesive, after 4 months immersion.</p>	<p>Figure 8. Back face of mesh sealed with WPM300 and then bonded with a C class non-F rated adhesive, after 4 months immersion.</p>	<p>Figure 9. Back face of mesh sealed with P9 and then bonded with a C class non-F rated adhesive, after 4 months immersion.</p>



It can be seen that the glass mesh is not affected by tap water, however alkaline lime water produced breakdown of the glass mesh, which could be scraped away. The glass mesh is unaffected by standard cement-based adhesives when it has been protected with a prime/seal coat.

NOTE

There are other difficulties associated with large thin sheet porcelain tiles (where dimensions exceed 1m on each side). The constraint is the drying performance of the adhesives. Cement based C class adhesives, unless F (fast set) rated, will display prolonged drying times with these tiles, especially when the substrate is waterproofed or relatively non-porous. The adhesive will cure, but it tends to remain physically damp and does not develop full strength in the normal time span expected. This can have negative consequences for flooring applications. It also means moisture is present longer than expected and assists in the development of alkaline conditions which will damage the glass mesh.

References

Molchanov V.S. & Prikhidko N.E. (1957) Corrosion of silicate glasses by alkaline solutions. *Bulletin of the Academy of Sciences of the USSR, Division of Chemical science*, Volume 6, Issue 10, p.p. 1179-1184

IMPORTANT

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