

TECHNICAL BULLETIN – TB228

EFFECTS OF ALKALINE CONTAINING MATERIALS ON GLASS MESH BACK TILES

Date, Thursday, 10 October 2013

INTRODUCTION & SCOPE

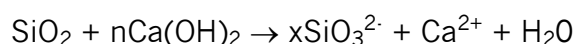
The recent trend towards using either very thin porcelain, or stone, and also structurally unstable stone, has led to the introduction of tiles which have glass mesh or woven matting bonded to the tile rear face.

In some cases the mesh is fully embedded in the resin that holds the mesh in place, but with others, the resin adhesive is only 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 looks at the potential for decomposition of the glass due to alkaline attack from lime in the adhesive, and subsequent problems with the tile bond due to changes and decomposition of the backing, and resistance to damage because of loss of mechanical re-inforcement.

WHAT HAPPENS?

Standard glass is not resistant to alkaline material such as the lime present in cement based adhesives. Over time the reaction of the lime with the glass in the presence of moisture causes the glass to break down. The general reaction can be characterised by this unbalanced equation derived from Molchanov & Prikhidko (1957) where in this discussion Calcium Hydroxide has been substituted for Sodium Hydroxide as the alkaline agent used in the original paper (lime = Calcium Hydroxide whilst Sodium Hydroxide is also called Caustic Soda).



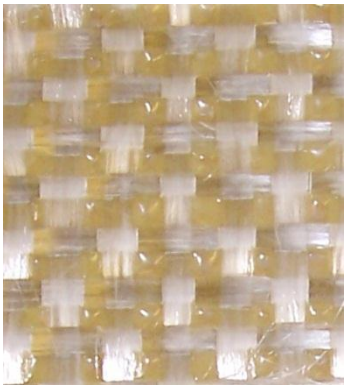
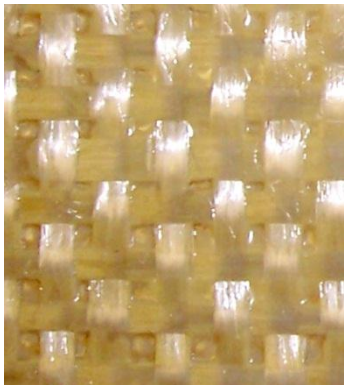
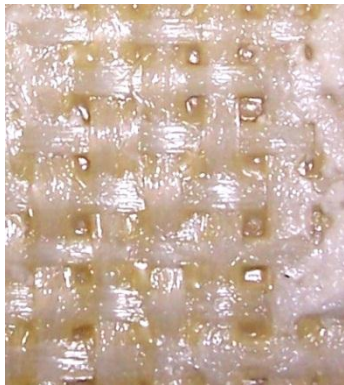


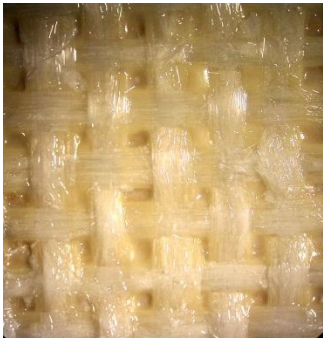
Basically the alkaline material attacks the glass by de-polymerisation and leaches out the silicates into solution. The end result for the glass is weakening and fracture of the strands.

This breaking down of the glass mesh, increases the potential for loss of integrity of the re-inforcement and a higher risk of mechanical damage (movement or impact from walking). The other potential issue is the development of reaction materials at the interface which are weaker than the original tile adhesive, with 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 (~pH12.4) and the results can be seen on the next page.

SOLUTION

The suppliers of the tiles need to use a glass for the mesh that has high resistance to alkaline attack, but also tile users can maximise the long term performance by using non-cement based adhesives such as epoxy, specialised rapid cure adhesives with reduced alkalinity effect (e.g. Ardex S16), but also effective control of moisture behind the tiles to stop alkali movement and activation.

 <p>1</p>	 <p>2</p>	 <p>3</p>
 <p>1a</p>	 <p>2a</p>	 <p>3a</p>
<p>Figure 1-1a.</p> <p>Fig 1. Shows the rear face of a glass mesh backed porcelain tile. Control material untested.</p> <p>Fig 1a. Same as above, but magnified 6.4x.</p>	<p>Figure 2-2a.</p> <p>Fig 2. Shows the rear face of a glass mesh backed porcelain tile. Material immersed in tap water for 9 months.</p> <p>Fig 2a. Same as above, but magnified 6.4x.</p>	<p>Figure 3-3a.</p> <p>Fig 3. Shows the rear face of a glass mesh backed porcelain tile. Material exposed to lime water for 9 months.</p> <p>Fig 3a. Same as above, but magnified 6.4x.</p>

As can be seen in the above images, the mesh is not affected by tap water, however lime water produced breakdown of the glass mesh, which could be scraped away.

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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