A Revolution of Materials using CalalSil's Water-Based, Liquid Ceramics.

All building materials need to be resistant to fire, sound and thermal conduction which by necessity means most of the mass of a built structure is made from ceramic materials. However, all ceramic (non-flammable) building products require either heat or a second activator or both to set the starting material into the finished product. Water is the activator for cement, which is the most commonly used ceramic in buildings and structures.

CalalSil™ has changed this forever with the introduction of the world's first stable water-based ceramic polymer. CalalSil™'s liquid ceramic is applied as a one-pack system and sets by evaporation causing curing of the geopolymer reactants into a hardened polymer concrete.

In recent time organic-based additives are applied to concrete mixtures to influence and improve its properties. Organic polymers such as acrylic and epoxy grouts have also been used as stand-alone products for niche applications mainly in coating systems. Regardless of these advances, ceramic materials are by far the most abundant building material by volume and mass for the majority of built structures in the modern world.

What's the need?

Three factors require improvement when using concrete or clay mixtures. These are:

1. Useability – concrete sets within a few hours of activation with water leaving a short timeframe to apply it on site or within manufacture. Even with careful management waste management of concrete is a critical issue for all construction and manufacture.
2. Fire resistance of concrete is below the temperature of most environmental fires including bush fires. This leads to a breakdown of the concrete structure during a prolonged fire.
3. Thermal resistance of concrete is poor compared with many other materials.
4. Durability and chemical resistance is enhanced by the use of expensive additives that coat the surface of concrete structures, blocks and walls.

CalalSil has solved these issues by inventing a method that produces a sialate (silicate) polymer which is then mixed with geopolymer reactive materials using conventional mix designs to produce the desired high solids fluid concretion which is stable for long-term storage provided water is not allowed to evaporate.

What has been done in the Market place?

Sealed concrete is the most common material currently used building material in the marketplace closely followed by sealed clay bricks and pavers.

Lightweight concrete is manufactured by adding aluminium powder to ordinary Portland cement water and aggregate which expands the material to include large quantities of small pores or bubbles. This product needs to then be steam cured in a large autoclave to ensure the product has the necessary durability. This product uses a high energy process that results in a moderately durable concrete requiring sealing to produce water resistance like most other OPC concrete mixtures.

Why will CalalSil's Liquid Ceramic Mixtures win in the end?

COST!

When properly scaled to a large manufacturing facility CalalSil's liquid ceramic suite of materials will be the equivalent cost with cement and concrete mixtures. This will be the case even when fly ash is replaced by thermally activated clay from the sites' nearby resource.

The basic reason for this is the lower energy input therefore, lower lifecycle cost of all plants' infrastructure when compared with cement plants that heat the lime mixture to temperatures above 1300°C to produce Ordinary Portland Cement OPC. These temperatures require refractory plant. In contrast Brick's activators are produced using chemical processing methods at temperatures below 350°C and the clay or fly ash activator mas a maximum temperature of 750°C. At this temperature there are a number of suitable long lasting metals that can be used as plant and equipment to replace the refractory equipment used in cement and fired clay manufacture.

FUTURE PROOFING!

- **3D PRINTING OF CERAMICS**
  - As a water stable ceramic that dries through evaporation, CalAlSil™ can be 3D printed onto almost any substrate or as a stand-alone object. This has implications for battery production, and renewable energy devices that require a rigid ceramic support to operate at peak efficiency.
- **NANOTECHNOLOGY OF CHEMICAL AND PHYSICAL MANUFACTURING**
  - The non-hybridised, 100% geopolymer uses either calcined clay or fly ash as the geological reactant with two activators. The first of these activators is CalalSil™'s sialate polymer which is stabilised by alkali ions in water. The second activator is the commonly used alkali (sodium or potassium) silicate that is currently used in MK750 geopolymer mixtures. This makes CalalSil™'s mixtures as easy to use as any paints, grouts, floor levellers, mortars and concretes.

    This mix design also makes CalAlSil™ easy to manufacture where the process of developing a building material no longer relies on excessively high temperatures, instead chemical and moderate thermal processes are combined to maximise efficiency and quality of the finished product.
- **THROUGH THICKNESS WATER PROOFING**
  - In addition, silicone polymers and oils can be added to CalAlSil™'s mixtures to provide a though thickness water resistance that is simply not available in concrete grouts without the use of significant amounts of flammable organic polymers. CalalSil™'s doesn't begin to char until 300°C. At this point flames are not produced due to the remaining chemically bound water in the ceramic matrix. As a result the ceramic nanostructure is mildly impacted allowing the material to retain its strength until 1800°C when significant vitrification occurs.

Crown CalAlSil™, Liquid Lava CalAlSil™ and Maven Magma CalAlSil™ are products that will forever change the type and style of building materials. These products use the nanotechnology of geopolymer technology to adhere to most substrates including wood, metals, concrete and brick.