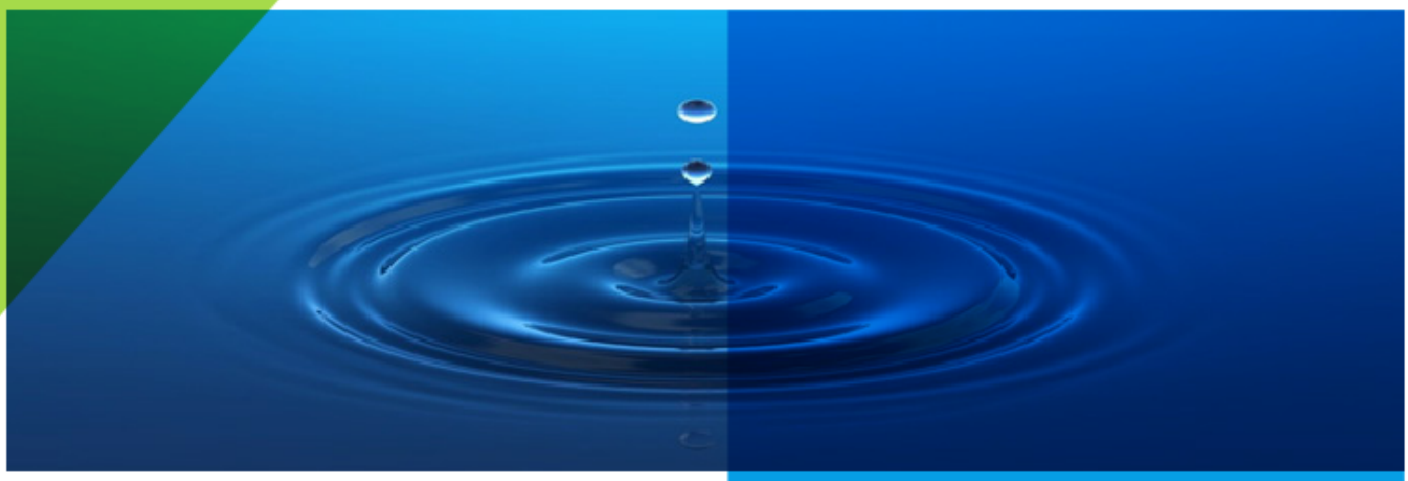
GEOKRETE™

MULTIPURPOSE ADVANCED GEOPOLYMER

- Can be made to set in few seconds to minute
- Curing Free
- Can set in Subzero Temperature
- Fire Resistant
- Can bind wide range of fillers and wastes
- Highly durable



ADVANCED GEOPOLYMER

Geokrete™ is advanced geopolymer based ultra high performance ceramic binder with extremely superior properties suitable for use in diversified industries apart from construction. Manufactured using minerals and inorganic polymers Geokrete complies with ASTM C 1600. It does not contain any Portland cement or organic resins.

WHY USE IT

The primary advantage of Geokrete™ is "Rapid setting and Curing Free" nature - "can be modified to set in few seconds to minutes" depending upon the application.

Concretes, grouts and mortars made with Geokrete™ can be formulated to achieve compressive strengths excess of 20 MPa or 3000 psi in less than 2 hours. It is possible to attain desired 28 day strength in 24 hrs - "Quick Return to Service".

Inherent chemistry and binding phase property make it to set in "very cold climatic conditions" and "tolerate very high temperature".

The bonding strength of it is extremely high and it "can bond to anything except glass and plastic" and "highly versatile" due to its ability to accommodate wide range of fillers and wastes.

Geokrete's highly dense microstructure along with very low porosity makes it an ideal choice to be developed for applications like High temperature concreting, Castable ceramics, Biomaterials, Innovative coatings, Advance building materials, Hazardous waste encapsulation and stabilization.

HOW IT WORKS

A strong, highly dense and durable matrix is formed based on the chemical reaction between inorganic polymer anions and metal cations. Faster dissolution and precipitation of constituents present in Geokrete™ results in the rapid formation of the binding phase.

HOW TO USE

Geokrete™ is water sensitive and to be activated by specific quantity of water depending on product. After mixing, the product needs to be used as quickly as possible.

INVENTION BACKGROUND

Although Portland cement has been successfully used for many years, it is not without limitations. Some of the common problems associated with Portland cement products are slow strength gain, cracking due to drying shrinkage, porosity, need of water curing, susceptible to attack by chemicals, Alkali Silica reaction, difficulty to set in low temperature, high temperature tolerance, etc.

At the same time there is also increasing need for binders with superior properties by different industries like biomaterial, coating, refractory, waste stabilization, etc which is beyond the reach of Portland cement

The quest for an ultra high performance binder to overcome the deficiencies of Portland cement and to cater a gamut of other industrial needs drove our efforts in R&D that resulted in Geokrete™.

OUR INNOVATION

Geokrete™ differs from conventional or traditional geopolymer from the perspective that it uses acidic media instead of alkaline to form the binding phase.

Slag, fly ash and Metakaolin are not essential ingredient of Geokrete™ making it strikingly different from conventional geopolymers

RESEARCH BACKGROUND

Geokrete™ is a patent pending technology invented by world renowned scientist at Ecomaterials, which is a independent research lab involved in research and development of innovative technologies in the area of alternative binders, high performance cements, advanced coatings, innovative building materials, effective utilization of industrial by products and hazardous waste stabilization.

Ecomaterials also has other inventions and patent pending technologies like Clinker free slag cement, Clinker free fly ash cement, permanent anticorrosive coating, alternative to gypsum board, etc

UNIQUE CHARACTERISTICS

RAPID SETTING AND CURING FREE

Formation of binding phase is much faster due to the rapid dissolution and precipitation of constituents and Geokrete™ sets by exothermic reaction with very minimal transformation time from liquid to sold state. It is a rapid setting binder and can be tailor made to set in few seconds to minutes depending upon the application need or product developed. Because of different reaction mechanism in binding phase formation Geokrete does not require water curing.

HIGH EARLY STRENGTH

The additives present in Geokrete™ increases the rate of dissolution of its components and precipitation of final product thereby achieving a faster strength gain

EXPANSIVE NATURE

Geokrete™ expands slightly during its setting because of its ability to bound water along with its reaction products coupled with the slight volume increase because of conversion of metal oxides to hydroxides. This prevents the formation of crack related with shrinkage normally observed in Portland cement based products

IMPERMEABLE

The quantum of water required to fluidize Geokrete is very less (about 50% less comparing to the Portland cement) and this coupled with the quick transition from the gel state to solid state makes its matrix very dense with negligible interconnected pores resulting in water absorption to near zero level

SUPERIOR BONDING

Geokrete™ without priming bonds to everything except glass and plastic. Provides both physical and chemical bonding. It has the self bonding characteristic and can be layered without any cold joints

WIDE RANGE PERFORMANCE

CAN SET IN SUB ZERO CONDITION

Its unique chemistry reduces the freezing point of the water thereby preventing the water from freeing at subzero temperatures enabling the chemical reaction to proceed. In addition Geokrete™ also generates its own heat due to exothermic reaction between its constituents present which assists in faster strength gain even at very low temperatures.

TOLERATES HIGH TEMPERATURE

Geokrete™ binder because of its poor thermal conductivity does not heat the substrate as rapidly as other binder do. Its mineral constituents get converted into a glassy phase material when heated beyond 1200°C and it becomes immune to very high temperatures, makes it suitable for high temperature applications.

FREEZE THAW RESISTANT

It's a well known fact than water expands by 9% when it freezes. The cumulative pressure of alternate freezing and thawing of pore water in Portland cement concretes causes severe problems like cracking, expansion and crumbling of concrete.

Because Geokrete possesses very less porosity and does not have connected pores, concretes made from it are far more resistant to the destruction caused by freezing and thawing of pore water.

CO2, ACID AND ALKALI RESISTANT

Geokrete™ is resistant to gases like Carbon-di-oxide, acids having a pH > 4 and alkalis due to its unique nature of achieving a near neutral pH and highly dense microstructure.

DURABILITY

Studies have determined that the use of superior binders date back to structures such as the Egyptian Pyramids, the Great Wall of China, the Roman structures, the Iron Pillar of Delhi and the Angkor Wat temple in Cambodia. These ancient cement chemistries, more recently referred to as a variant of geo-polymer. Durability of it is practically known today.

Primarily the structural disintegration starts by formation of ices in the micro pores of the binder in the night and deicing of the same in day. Repetition of this cycle leads to micro cracks and it is propagated further. Geokrete is more durable than Portland cement due to its dense micro structure and non-connected pores.

Absence of mineral phases like tricalcium aluminate in Geokrete makes it highly resistant to sulfate attack.

Because of its dense nature Geokrete gives excellent results when tester for its chloride permeability as per ASTM 1202. This gets translated into achieving the best rebar protection against corrosion when the work is done with Geokrete.

These two properties makes Geokrete an ideal choice for any application that requires sulfate and chloride resistance.

The impermeability due to dense microstructures provides the immunity from the chemical attacks by salts like Sulphates and Chlorides present in water and Carbon-di-oxide like corrosive gases present in air.

VERSATILE

Geokrete binder offers greater promise for the production of bio fiber based composite materials. It gives better properties to the final product when compared to some of the current cement and polymer resin based binder systems.

The areas in which Geokrete excels when compared to other systems are fire resistance, milddew resistance, dimensional stability and durability. One can use Geokrete™ binder to produce value added products from wood waste, agricultural waste, wood processing residue, and paper mill residue etc.

WASTE TO WEALTH

Geokrete™ binder can be altered inducing desired property depending on the industrial waste nature and it can be used to accommodate the waste to make useful product. While doing so the hazards in the waste can get stabilized or encapsulated and the leaching issues because of land filling of the waste are taken care of.

Typical example is that Geokrete™ was used to bind the spent or used sand in India's largest foundry and an acid resistant tile was developed. Normally these sands are coated with resin and due to the leaching issues disposal of it is a tough task where Geokrete™ binder provided the eco friendly solution

Another example where Geokrete can be used to convert waste into wealth is the drill cuttings that comes out of oil well can be captured and can be mixed with Geokrete binder.The resultant slurry either can be reinjected into the well or can be made into solid blocks which can be used for making sub-bases of roads.

ABILITY TO STABILIZE WASTE

Geokrete™ is formed by the chemical reaction between inorganic metal oxides and polymer solution unlike in Portland cement system. The chemistry of the reaction process has the advantage that it can be used to treat wide range of wastes. The stabilization process using our proprietary Geokrete™ binder involves the reaction between the contaminants and the binder components at room temperature resulting in the conversion of hazardous substances to a more stable and insoluble form.

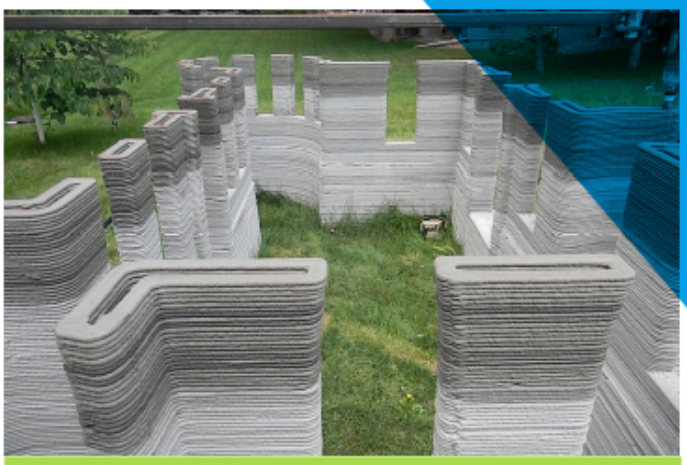
The advantage of using Geokrete™ in waste stabilization

- Room temperature process
- Fast setting nature prevents the workers exposure
- Passing of corresponding environmental norms
- Higher waste loading, hence minimal storage space
- Binder can be easily transported to contaminated site
- Treated or stabilized waste can be reused at the same site
- Safe transport of stabilized wastes
- Fire retardant binder
- Does not use any toxic materials in the binder formulation
- No need to use potable water, Sets with saline water

SINGLE BINDER FOR MULTIPLE INDUSTRIES

Geokrete™ technology can be used to develop products for multitude of applications for various industries due to its unique and superior properties and wide performance range.

- Oil Fields
- Biomaterials
- Coatings
- Fire resistant
- Anticorrosion
- Radiation shielding
- Waste stabilization
- Castable refractory
- Electronic materials
- Composite building products
- Low cost housing
- Structurally integrated panels (SIP)
- Tiles (Cool roof, thermal insulation)
- Panels (like Noise insulation)
- Architectural Molded Products
- Concrete and structural repair
- Construction chemicals
- Industrial waste to wealth ….



WHAT WE DO WITH GEOKRETE™

One of our key scientists was involved in fundamental research and invention of unique kind of geopolymer in USA during 2000. Later we continued the basic and application oriented research by modifying the characteristics of the ingredients used to manufacture Geokrete for about a decade and developed the user friendly Geokrete™ technology.

Since Geokrete™ technology is useful to various industries and for different applications, at Ecomaterials we modify its properties depending upon the application need and help our clients to develop next generation products in their corresponding field of interest. Tech4trans is supported by state of art material science laboratory, pilot plants and product development team with scientists and engineers.

There are two types of licenses that can be granted – exclusive and non-exclusive licenses. An exclusive Intellectual Property(IP) license, as the name suggests, allows the licensee to be the sole party to use the IP. A non-exclusive license allows the IP rights to be used by more than one licensee.

Exclusive IP license is granted in certain situations where the IP requires significant further investment into the product to make it market-ready. Where an exclusive license is provided, it will typically be restricted to:

- Specific fields of use those are sufficiently wide to address the licensee's potential market segments.
- Particular geographic areas where the licensee is confident of the market.

Non-exclusive license is granted when the IP has a broad scope and can be used in multiple industries or applications by different companies.

APPLICATIONS

CONSTRUCTION

Rapid construction and repair

Geokrete-PR a products based on Geokrete™ technology has been widely used as structural repair material. It sets up in few minutes and lead to quick return to service in less than 2 hours. Coupled with unique properties like freeze thaw resistant, no water curing, non shrink, excellent bonding to almost everything and to itself, immune to chemical attacks, etc makes it an ideal choice for critical repair applications like

- Airport runway, Bridge deck, Port jetty
- Highways (Pot hole)
- Structural concretes, Industrial flooring
- Grouting of precast pieces ...

Cold weather concreting

Geokrete™ technology can used to formulate concretes which can set in minutes rather than days even at sub zero temperatures up to - 10°C which is useful for applications like cold weather concreting, freezer floor repair, etc

High temperature concreting

Geokrete™ because of its nature to form highly dense matrix coupled with its high thermal diffusivity rates can be used to develop concretes that can tolerate temperatures as high as 1200 C. The potential applications include pads for vertical take of and landing, periphery of rocket launch pad, Space for spent fuel disposal tank, Foundry, Steel and Melting plants, Molten mineral processing facilities, Military aircraft engine testing facilities etc

COATINGS

With Geokrete™ the possibilities of developing a coating based inorganic materials becomes an reality. Traditionally the coating industries have relied heavily on using organic polymers to develop coatings for various applications which not only creates health hazards but also has other functional shortcomings. Now with the advent of Geokrete it is possible to develop a range of coatings starting from Anti corrosive coating to high temperature coatings using Geokrete technology.

Using underlying Geokrete™ technology, we helped to develop an advanced high temperature anticorrosive coating in USA.

OIL WELL CEMENT

Oil well industry, till now, has depended on modified Portland cement, but there are number of areas where it is not reliable. It does not set easily at low temperatures, because the water in it will freeze even before the cement sets. Free calcium hydroxide present in it is affected by down hole gases like carbon di oxide and chemicals such as sulfates and chlorides as a result, cement performance becomes poor leading to failures. Because of the ability of Geokrete™ to set at low temperatures and resist attack from sulfates, Chlorides and gases like carbon di oxides which are present in the down hole it becomes an ideal choice for cementing steel casings in an oil well when the conditions inside the well become ascerbic.

Using underlying Geokrete™ technology, we helped to develop an advanced oil well cement for our client in Canada.

CASTABLE CERAMICS

Geokrete™ can be developed to provide protection lining for steel pipes that may find its use in industries like cement, power, mineral processing, mining, paper pulp etc because of it high temperature resistant properties and its ability to accomodate wide range materials as fillers.

BIOMATERIALS

Geokrete™ has multitude of applications in the areas of biomaterials because of its unique properties like good injectability, good resorpability, self setting ability, moldability, biocompatibility, osteoconductivity, bioactivity, ability to deliver biomolecular compounds, ease of preparation and low cost.

Due to the unique properties, Geokrete™ technology can be used to develop an advanced bone and dental cements which can be ideal for a wide range of applications starting from bone void fillers, filling holes left by routine tooth removal, space filling during spinal fusions and maxillofacial reconstruction.

RADIATION SHIELDING MATERIALS

Geokrete™ can be formulated to develop radiation shielding concrete with which required shielding effect can be achieved in very less thickness when compared to the one made with conventional materials. Potential area of application includes nuclear facilities, radioactive medical waste stabilization, etc.

Geokrete™ technology can also be used to develop radiation shielding coatings.

ELECTRONIC MATERIALS

Geokrete™ because of its unique characteristic of accepting wide range of filler materials in its matrix can be developed for various electronic applications which include but not limited to insulators with low dielectric constant at room temperature by incorporating different materials having different properties. A multiphase material could potentially be formed at room temperature using Geokrete binder having phases with various different properties that would contribute to the whole composite.

CONSTRUCTION CHEMICALS

Geokrete™ is a ultra high performance binder which can be used to manufacture unique quick setting and curing free products with superior properties – An ideal choice for Construction Chemical and Premixed Products Manufacturers

Some of the products which can be readily formulated by adding different additives like polymers, defoamers, retarders, and accelerators are

- Rapid repair mortar **RTS in 2hr with 20 MPa strength**
- Instant concrete **RTS in 2hr with 20 MPa strength**
- Rapid set anchoring grout **RTS in 2hr with 20 MPa strength**
- Water plugging cement **RTS in 1 minutes**
- Instant crack filler **RTS in 15 minutes**
- Watertight tile grout **RTS in 60 minutes**
- Selfleveling underlayment **RTS in 2hr with 5 MPa strength**

BUILDING MATERIALS

Geokrete™ technology can be used to develop multiple next generations building materials by addition of performance additives and deriving required properties.

COOL ROOF TILE

Based on one of our client requirement, we have developed a monolithic light weight (11 mm thickness) cool roof tile based on Geokrete™ which reflects heat waves with Solar Reflective Index (SRI) more than 97 and water proof.

COMPOSITE BUILDING MATERIALS

With the ability of Geokrete™ technology to bind wide range of materials, various advanced building materials like specialty panels (noise and thermal insulation), structurally integrated panels (SIP), composite building blocks having cellulose, fibers, wastes, etc can be manufactured...

GEOKRETE™

For Products & licensing of the technology

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Ecomaterials invents and offer innovative technologies to its clients enabling them to develop products of the future and achieve competitive edge and enhanced market position.