

Virti-Reinforce

A phosphate-controlled dissolution glass that is designed to stimulate mineral transformation and growth to strengthen the deployment environment while maintaining inherent permeability. The treatment stimulates mineral deposition and artificial rock formation at the target location to strengthen the well structure and prevent natural rock collapse or degradation. The strengthening effect is permanent and preserves 80 to 100% of the permeability as documented in laboratory testing and in the field. It is possible to remove the strengthened layer, if needed, using suitable acid-based treatments.

The glass solution is tailored for each application in order to achieve the correct chemistry for the given rock type and well conditions. A solution for reinforcing chalk formations has been designed and field proven with successful results. Other solutions for different formation types, such as sand, are feasible and currently under development.



Ideal solution for:

- Strengthening weak and unconsolidated reservoirs formations while maintaining permeability and ability to produce.
- Reinforcing acid-treated chalk formations.
- As a stand-alone or in combination with other proppants for fracturing operations.
- Open hole MLT wells.

Tailored design properties

The glass solution can be tailored to the specific needs for each application. Key design properties:

Permeability

Tailored to retain native formation porosity and permeability (lab tested to retain 80-100% permeability in chalk).

Formation reactivity

A solution is ready-to-use with Chalk/Calcium Carbonate based formations. Solutions for other formation types are feasible and under development.

Strength

Laboratory tests have documented an increase of tensile strength of 3 to 5 times of the original formation after treatment

Other properties:

Product form	Particle size	Bulk density	Mixing concentration	Final Solution Density	Approved Mixing agents
Bulk Powder mixed into solution	Average diameter between 5 to 30 μm	2.5 g / cm^3	2.5 to 5 % by weight	1.03 to 1.30 sg.	Water, Seawater, Sodium Bromide Brine, Other Brines

Setting Time	Rheological Properties	Injectability
1 to 2 hours at 70 ° C and higher	Like Water. YP = 0, PV = 1 cP. Dependent on mixing medium	Tested to successfully inject into 1.5 mD permeability.

Handling and storage:

Delivery options	Mixing method	Storage Requirements	Shelf Life
Pre-mixed in concentrated or ready-to-pump solution	Standard mixing into solution through hopper and blender	If Bulk – Keep dry and away from moisture. If Pre-mixed – see specific guidelines based on mixing agent	Minimum 12 months

Additional properties:

pH (mixed in solution for use): 1.2-1.6*

*When mixed in solution Phosphoric Acid is formed. Reactivity and corrosion were extensively tested with different materials commonly found in drilling and completion. No significant corrosion has been documented with these materials.