LockCem™ Cement

A resin-blend cement system

LockCem™ cement is a proprietary blend of a water-tolerant resin, WellLock® resin system, with any class of Portland cement. This blend is compatible with Halliburton additives, enabling the cement system to be customized for specific pumping-operations and wellbore conditions. Research has shown that the addition of resin to cement can result in improved mechanical properties in comparison to the base cement.

LockCem cement provides the best of both the resin and the cement qualities, while overcoming the challenges of oilfield resin use. Only a percentage of the overall blend involves the resin system, which enables the economic use of the high-volumes of slurry required for primary cementing while conveying specific properties for improved cement-system performance. The resin transmits long-term performance advantages to the cement sheath including increased compressive strength, a lower Young's modulus for greater ductility, and an increase in shear bond strength. Permeability of the cement can also be significantly reduced due to the incorporation of resin in the design.

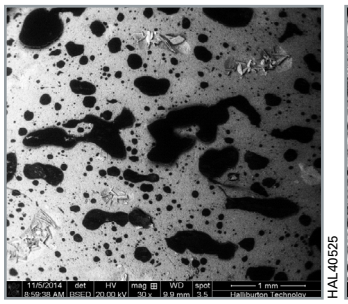
The resin blended in LockCem cement is Halliburton's proprietary WellLock resin system, the only resin system used in oilfield applications that can be pumped ahead of, behind or blended with water-based fluid systems. This is because WellLock resin does not become volatile upon contact with water.

Other oilfield resins react exothermically when in contact with even small amounts of water, presenting concerns for health, safety and non-productive time.

The resin system in LockCem cement forms a dense, highly cross-linked matrix. The extent of the cross-linking reaction is determined primarily by volume, temperature and time. The distribution of resin throughout the slurry acts like shock absorbers between the particulates of the cement, increasing ductility and the resiliency to withstand stress from load-inducing events throughout the life of the well.

Customizable / Higher Performance

The slurry design for LockCem cement can be customized for specific properties to accommodate the short-term displacement and flow performance attributes as well as properties for the solid-set cement sheath for long-term downhole performance. Short-term, dynamic properties that can be customized include density, viscosity, rheology, fluid loss, static gel strength, thickening time and compressive strength development. Long-term properties that can be tailored for each well plan include compressive strength, corrosion resistance, ductility, and cement-to-casing and cement-to-formation bond integrity.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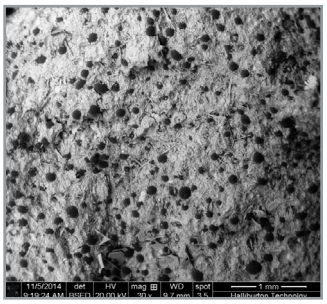
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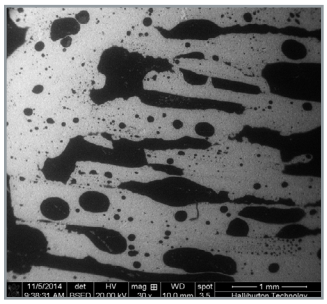
These 30x-magnification images are of a 20-percent-resin-by-volume LockCem ™ cement sample: (l) exterior of the sample; (r) interior bulk fracture surface.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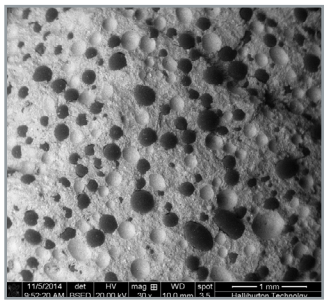
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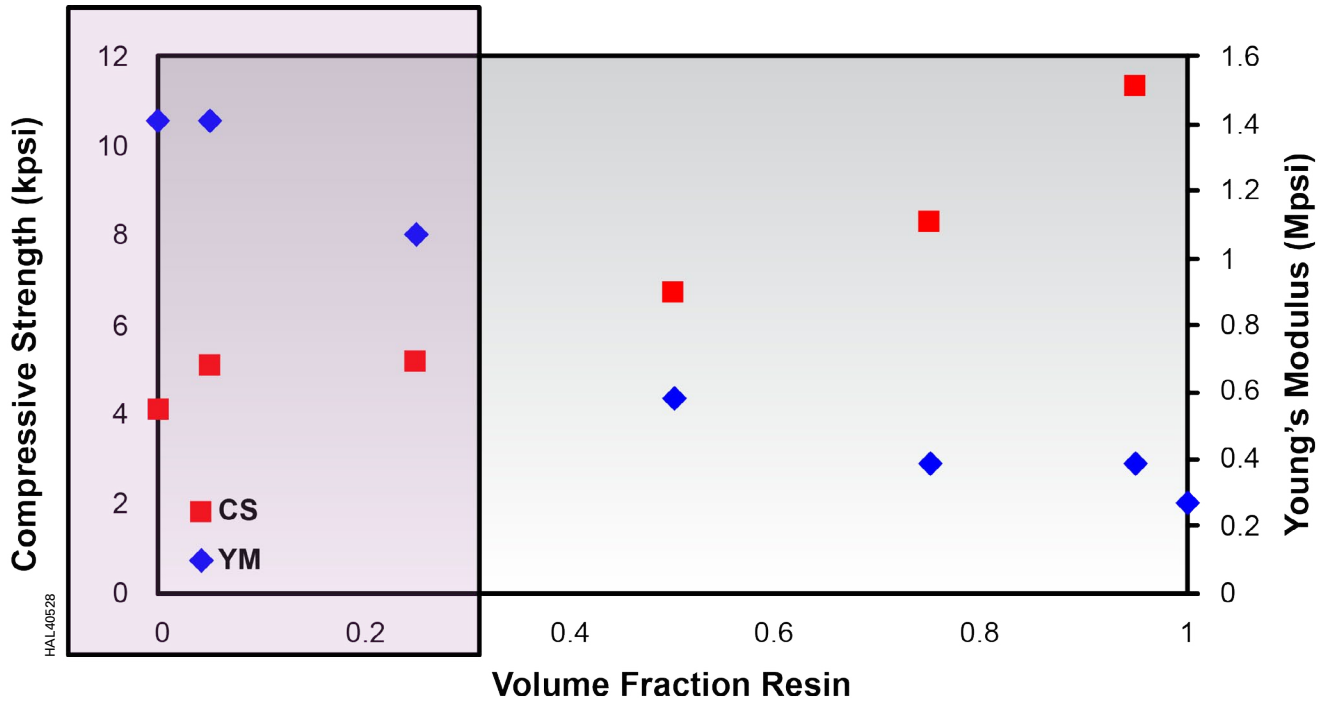
These 30x-magnification images are of a 30-percent-resin-by-volume LockCem ™ cement sample: (l) exterior of the sample; (r) interior bulk fracture surface.

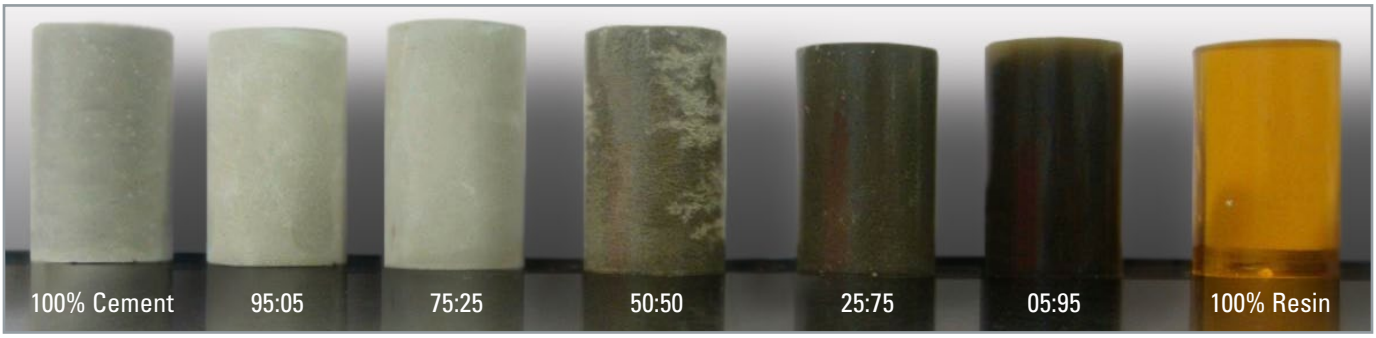
LockCem™ Cement – Mechanical Properties

Research has shown that the addition of resin to a cement system can lower the density, while improving mechanical properties in comparison to the base cement.

	Density (ppg)	Compressive Strength (psi)	Shear Bond (psi)
Base Cement	16.4	5705	610
LockCem Cement (20% resin by volume)	14.9	6105	720

The chart above shows the data indicating an increase in shear bond and compressive strength of LockCem cement versus the base slurry. The graph below shows the compressive strength and Young's modulus data in a LockCem cement samples ranging from 20% to 80% resin by volume.





A variety of LockCem cement laboratory test samples (percent-mix of resin shown below each sample) shown with the base slurry (far left)and a neat WellLock resin sample (far right).

For more information on LockCem™ Cement, please call your local Halliburton representative or email us at cementing@halliburton.com.

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