EverCRETE \textsuperscript{TM} CO\textsubscript{2}-resistant cement system

Extend cement barrier lifetime in reservoirs containing CO\textsubscript{2}

\textbf{Temperature:}
up to 266 degF [130 degC]

\textbf{Applications}
- Carbon capture and storage wells
- Wells in fields that use CO\textsubscript{2} injection for enhanced oil recovery (EOR)
- Primary cementing in CO\textsubscript{2} environments
- Long-term decommissioning objectives for plug and abandonment (P&A) in CO\textsubscript{2} environments

\textbf{What it replaces}
Portland cement systems are used conventionally for zonal isolation in wells. However, portland cement is thermodynamically unstable in CO\textsubscript{2}-rich environments and can degrade rapidly upon exposure to CO\textsubscript{2} in the presence of water. As CO\textsubscript{2}-laden water diffuses into the cement matrix, the dissociated acid (H\textsubscript{2}CO\textsubscript{3}) reacts with the free calcium hydroxide and the calcium silicate hydrate (C-S-H) gel. The reaction products are soluble and migrate out of the cement matrix. Eventually, the compressive strength of the set cement decreases and the permeability and porosity increase, leading to loss of zonal isolation.

\textbf{Why it’s ideal in any CO\textsubscript{2} environment}
Well integrity has been identified as the biggest risk contributing to leakage of CO\textsubscript{2} from underground carbon capture and storage sites. EverCRETE system enables efficient underground storage and keeps greenhouse gases out of the atmosphere for a long time.

For wells in fields that use CO\textsubscript{2} injection for EOR or may use it in the future, EverCRETE system reduces the risk of cement sheath degradation and leakage. It can be used to cement new CO\textsubscript{2} injection wells or to plug and abandon injection or production wells at the end of the field life.

In case there is damage to the cement matrix and CO\textsubscript{2} starts to migrate, the self-healing capabilities that can be incorporated in EverCRETE system will repair the crack, reestablishing the integrity of the well and recovering zonal isolation.

EverCRETE system can also be used as a cement across potential CO\textsubscript{2}-producing formations or as the primary barrier in the wellbore for in situ fluids after abandonment and permanent decommissioning.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{compressive_strength.png}
\caption{Compressive strength evolution of portland cement and EverCRETE system samples with time in wet supercritical CO\textsubscript{2} fluid and in CO\textsubscript{2} saturated in water at 194 degF [90 degC] under 28 MPa of pressure. After 6 months in CO\textsubscript{2}-saturated water, the compressive strength of portland cement is not measurable because most of the samples are highly deteriorated. The stability of the EverCRETE system minimizes the degradation potential of the long-term barrier.}
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