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Assessing the Efficacy of Thermal-Sensitive Polymer Gels for Temporary Wellbore Sealing: An X-Ray Computed Tomography Analysis

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The shift from fossil fuel-based energy sources and toward more environmentally friendly, renewable alternatives highlights how important it is to properly plug and abandon oil and gas wells. Most depleted wells in the energy industry have been allocated for initial-phase abandonment, and cement has long been an appropriate material for permanently plugging these wellbores. Permanent plugging might not be appropriate everywhere, though, as depleted well sites provide a promising option for underground CO2 storage.

This work investigates the possibilities of short-term plugging solutions, with a particular emphasis on the application of novel thermal-sensitive polymer gels as an alternative sealing material. These gels provide a reversible and safe way to seal wellbores, keeping them intact for potential CO2 storage. The investigation of the polymer gel's flow through fractured chalk formations has been performed using X-ray computed tomography.

A wide range of experimental studies have been carried out in conjunction with real-time CT scanning to track the evolution of the polymer gel in chalk formations. The objective of this investigation is to ascertain the ideal concentration of the polymer gel and evaluate its efficacy in providing a temporary closure for the wellbores while ensuring their appropriateness for CO2 storage in the future. The research's conclusions have significant consequences for the oil and gas sector, especially when it comes to environmental sustainability and the shift to cleaner energy sources in the future.

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