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Tech Trends

Crystal ball for under-balanced drilling

3M's Hollow Glass Spheres were adopted by PetroChina for use in an under-balanced drilling project in the Sichuan Basin in April 2007. The lightweight glass spheres were blended into a water-based mixture to produce drilling fluids with densities of 0.9 g/cc, targeted at under-pressured or depleted reservoirs. High formation temperatures and pressures, a tendency for borehole collapse, borehole deviation, poor drillability and low drilling speed have long hampered gas prospecting and production in this region.

To raise productivity, the operator undertook a major project to evaluate the use of hollow glass spheres (HGS) in drilling fluids for the first time in China, at the **Guang An** gas field in the Sichuan Basin. The target well, Guang An 002-H1 is the longest horizontal well in the basin, with a horizontal section stretching approximately 6,562 ft (2,000 m).

The exercise optimized well parameters by designing drilling fluids to manage the pressure differentials in the formation, thereby reducing formation damage. As a result, the well recorded a threefold increase in productivity over that of the vertical wells in the region. This is due in part to the non-invasive nature of the drilling fluid when drilled under-balanced.

Hollow glass sphere-based drilling fluids are non-compressible fluids with stable densities across the well bore that allow for managed-pressure drilling in low-pressure formations without the use of air or other gases. This allows for reduced drilling-related problems and increased rates of penetration. The glass spheres create a low head differential or near-balanced drilling condition where the hydrostatic head of the wellbore fluid column is reduced to slightly greater than the formation pressure, thereby containing the flow of formation fluids during drilling.

Hollow glass spheres can be added to virtually any type of existing fluid system in order to reduce density. The glass spheres extend the density window of a single phase liquid into a density range that is normally only achievable by injecting a gas into the liquid.

The drilling fluids used in the wells at Guang An were water based and designed to a density of approximately 0.9 g/cc. www.3m.com/oil&gas



The concept of low density drilling fluids designed around hollow glass spheres is gaining momentum in China with more field applications recorded in the Sichuan and Ordos Basins. (Photo courtesy of 3M)