Application of the Ahead Fluid System in the Moxi16 Liner Cementing

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ABSTRACT
An efficient ahead fluid was utilized to make good cementing by effectively removing mud in a long open hole with narrow clearance. The fluid was formulated by combining appropriate flushing fluid and high density anti-salt fluid, and applied to a Moxi16 well. It was drilled to 4849 m with 215.9 mm drill bit in a 177.8 mm (diameter) casing. It was difficult to cement properly due to narrow space, low casing centralizers, high temperature gradient and intermittent presence of oil and gas. An efficient ahead fluid system with proper rheological properties resulted in acceptable cementing quality and zonal isolation.

KEY WORDS: Cementing quality; ahead fluid; spacer fluid; gel strength; displacement efficiency.

NOMENCLATURE
PV = plastic viscosity
YP = yield point
n = flow behavior index
K = consistency index
T = temperature

INTRODUCTION
Moxi 16 well is a wildcat well positioned at Northeast Earthquake roof in Sichuan basin. To understand the characteristics of the reservoir and fluid bearing conditions of Longwangmiao group Cambrian system of Mo-xi buried structure, the Moxi16 well is designed 5176 m depth, with a drilled depth of 4849 m. Polysulfonate organic salt mud was used in the drilling well, with the mud density is 2.15g/cm³. The Fourth Spudding in Moxi16 Well used drill bit Ф215.9mm, and Ф177.8mm liner hanger cementing with packer. Its hanger position is 3025 m, and the superposition section is 250 m. The double setting elastic self-healing cement was used in the drilling well, with the slurry density 2.3g/cm³. When the fast setting cement slurry arrived at 3800 m (about 1049 m), the retarding cement slurry arrived at 3025m that cemented the Jialingjiang group and superposition section (about 775m ). Due to complex nature of the geological condition and interruption of fluid circulation during drilling, it is hard to properly executing cementing process.

The characteristics and difficulties analysis of Moxi16 well cementing
The Moxi 16 well has a few unique characteristics including high bottom hole temperature and presence of oil and gas on top of complex geological system. This makes difficult cementing properly and therefore a new process was proposed as follows:

(1) With small annular clearance and difficult casing center, the casing running process is easy to occur stuck pipe or surge pressure always leads to a lost circulation. It was drilled to 4849m with Ф215.9mm drill bit, and Ф177.8mm casing was run down to the depth of 4849m. Since the open hole section of Moxi16 well is long 1574m.

(2) The viscosity of cementing slurry is higher than drilling fluid so that the flow resistance of cementing slurry is bigger than drilling fluid. Further the casing string is hard to centering, and the displacement of drilling fluid is limited under the narrow safety density window which may cause drilling fluid annulus channeling.

(3) There are high compatibility threats between organic salt high density drilling mud and conventional high density cement slurry. When they were blended, the viscosity of the blending slurry increased and thickening time shortened, which makes adverse effect on operation safety and cementing quality. So it went against to developing fluids compatibility and improving displacement efficiency.

(4) As the mud has high density, large viscosity and yield value, it is difficult of well cleanout with high flow rate circulation. When plenty of thick mud and mud cake adhering to the surface of borehole and casing, it leads to well cleanout difficulty.

(5) It was difficult of designing slurry formulation and making experiments under a large temperature difference cementing condition. With the high bottom hole temperature, frequent showing of oil and gas, large temperature difference, the bottom-hole static temperature is estimated as 142°C. And according to the temperature coefficient is 0.85 , the bottom-hole circulating temperature is about 113°C, the bell mouth static temperature is 87°C.