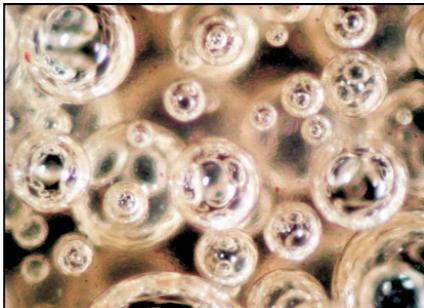


Novel drilling fluids the focus of Drilling Fluids II

APHRON-BASED FLUIDS

A NOVEL DRILLING fluid containing specially designed micro-bubbles, “aphrons”, was recently introduced and has now been employed successfully in various parts of the world to drill through formations that previously experienced uncontrollable losses and a high incidence of differential sticking. The aphon-laden fluid appears to be particularly well suited for drilling through depleted zones. Wellbore stabilization is accomplished by greatly reducing the rate of invasion of the base fluid with additives that minimize the thixotropy of the fluid and enhance its shear-thinning character, and reversibly plugging pores and fractures by the aphrons.



A novel drilling fluid containing specially designed micro-bubbles, “aphrons”, has been employed successfully in various parts of the world to drill through formations that previously experienced uncontrollable losses and a high incidence of differential sticking. IADC/SPE 87134

A recent innovation resulted in modification of the original fluid design to permit incorporation of selected clays in the fluid for rheology control and stabilization of the aphrons. Additionally, the chemistry of the aphon membrane has been altered using a polymer/surfactant package to improve the bubbles’ the longevity and resistance to pressurization.

This alternative aphon-base drilling fluid has been tested in the Gulf of Mexico which, until now, has experienced severe losses in a long vugular sand section. The results suggest that the new aphon-based mud can seal problematic loss zones effectively.

The authors will discuss the design and properties of the new alternative aphon-based drilling fluid and how these characteristics can be used to advantage in a drilling operation.

Application of Alternative Aphon-Based Drilling Fluids in Bay of Campeche (IADC/SPE 87134) **F B Growcock, G A Simon, A B Rea, M-I Drilling Fluids LLC; E Noello, R Castellan, M-I Drilling Fluids LLC; J M Climaco Gomez, Pemex.**

BARITE SAG

When drilling with oil-base drilling fluids, the ability to maintain all the weighting agents in suspension is particularly difficult since these fluids are more vulnerable for sag than water-base drilling fluids.

It has been shown in a study that the ability to keep barite in suspension also depends on the chemical composition of the water phase. The study evaluated the sag tendency of a mineral oil based drilling fluid, a linear paraffin based drilling fluid and both an ester and a LAO based synthetic drilling fluid. A selection of drilling fluids were made in which all had the same water activity in the internal phase.

For all the fluids, an improved performance was observed if the traditional calcium chloride salt was exchanged with a selection of other salts as the internal salt gave generally better performance than if calcium chloride was used. The best performance with respect to sag was observed using an ammonium calcium nitrate as the internal salt phase.

The authors will describe the effect of the internal salt phases of the water in oil-base drilling fluids on sag performance. The author will also outline the effects these of salts in different oil based drilling fluid systems have on possible drilling waste remediation after a drilling operation.

The Effects of the Oil-Based Drilling Fluid’s Internal Water Phase Composition on Barite Sag (IADC/SPE 87135) **T H Omland, A Saasen, K Svanes, Statoil ASA; T Albertson, HIS; K Taugbol, M-I Drilling Fluids LLC.**

BARITE SAG MANAGEMENT

Barite sag continues to be a recurring, potentially serious problem on many directional wells. Despite efforts by the drilling industry and early progress, recent continued improvements in sag mitigation have been limited.

Sag is a particular problem on HTHP wells and in deepwater wells where ECD management is required. These wells pose difficult drilling conditions where drilling practices may offset sag-management advancements.

The sag “magic bullet” has thus far been elusive. Sag is affected by many parameters and their interactions are difficult to quantify. While the importance of mud rheology is well known, attempts to find the key rheological parameter have not been completely successful. Lack of industry standards to measure and report barite sag has limited the availability of usable field data. Sound engineering strategies and guidelines have helped, but more developments are needed.

The authors will examine key barite-sag challenges and barriers; discriminate among sag facts, theories, and perceptions; characterize current best practices; and discuss opportunities and active programs for step improvements.

Recent barite-sag case histories from the Gulf of Mexico, West Africa, Eastern Canada, and the North Sea will be presented to set the proper perspectives. The authors will also present several active operational and industry research programs that show promise for step improvements in sag management.

Barite Sag Management: Challenges, Strategies, Opportunities (IADC/SPE 87136) **P D Scott, Marathon Oil Company; M Zamora, C Aldea, M-I Drilling Fluids LLC.**

CLAY-FREE SYNTHETIC

Since the introduction of invert emulsion fluids in the 1960s, oil- and synthetic-base fluids (SBF) have been formulated with a similar group of components: base oil, organophilic clay and lignite, lime, CaCl₂ brine, and emulsifier. The

family of invert emulsion fluids has remained closely related in terms of mud properties and performance expectations.

In 2001, a synthetic-base fluid formulated entirely without commercial clays or lignites was introduced in the Gulf of Mexico. Rheological properties are controlled through the emulsion characteristics, a radical departure from accepted solids suspension mechanisms. The behavior of this unique fluid has changed perceptions about what constitutes "good mud."

The clay-free, emulsion-base fluid has consistently prevented detectable barite sag on more than 80 wells drilled to date. Based on observed fluid densities after long static periods (an 8-day logging run in one case) and verified by Modular Dynamic Test (MDT) log data on numerous high-angle wells, the fluid's unique emulsion structure and wetting characteristics prevent settling of barite and other solids.

Benchmark Performance: Zero Barite Sag and Significantly Reduced Downhole Losses with the Industry's First Clay-Free Synthetic-Based Fluid (IADC/SPE 87138) **B Owen, K Burrows, D Carbajal, J Kirsner, Baroid Drilling Fluids.**

LOW VISCOSITY FLUID

Conventional oil-base drilling fluid was found to be inapplicable for drilling narrow hole annuli in a mature field offshore Norway. An oil-base drilling fluid with reduced viscosity and improved sag stability was needed for these wells with a limited hydraulic window.

A totally reformulated drilling fluid system was developed. The combination of base oil selection and product selection produced a fluid with a flatter rheological profile that results in reduced plastic viscosity and increased low shear rate viscosity. This rheological profile has direct impact on pump pressure and hole cleaning capabilities.

The fluid has been field proven through drilling several challenging reservoir sections varying in hole sizes from 5 7/8-in. to 8 1/2-in. Narrow hole sizes with limited hydraulic windows often cause ideal situations for barite sag since low pump rates and slow tripping speed are necessary to control downhole pres-

ures. This drilling fluid system has shown to be much more sag stable than conventional oil-base mud in these situations even though the rheological properties have been substantially reduced.

The authors will present the experimental work performed when developing the system as well as presenting field data from the use of the new drilling fluid sys-

tem compared to the use of more conventional systems.

Reformulating Oil-Based Drilling Fluid by Using Specially Selected Chemicals led to Development of a Low Viscosity High Sag Stability Drilling Fluid (IADC/SPE 87139- Alternate) **K Taugbol, G M Sandberg, H Grevstad, M-I Drilling Fluids LLC.** ■