Ceramic cement forms new bond in industry

By Diane L.M. Cook

The drilling sector will soon extol the environmental benefits of ceramic cement. Heralded as the latest in cement technology, ceramic cement generates less emissions during the production of the product, it recycles waste material by encapsulating other materials, and it protects the environment from the unwanted release of gas, drilling losses, or water inflow.


Bonds to itself

Patented by Argonne National Laboratory and licensed to Cemblend Systems Inc. under the name of Ceramicrete, ceramic cement is a novel, versatile phosphate ceramic developed for oilfield applications. Ceramic cement is made by mixing magnesium oxide powder, a soluble phosphate powder, a pozzolanic filler, and water. The end result is a non-porous material with a compressive strength higher than most Portland cements.

Products

Cemblend's two products made with Ceramicrete are Microceramic and DuraSeal. Microceramic is an adjustable set time ceramic micro fine cement and DuraSeal is a larger particle size ceramic cement.

Microceramic is specifically designed for use in shallow well water and gas control as well as wellbore stabilization. Microceramic is injected into the permeability or microfractures of wellbores to stabilize them and to shut off gas migration and water flow from within the permeability.

"The difference between using Portland cement and ceramic cement is that in shallow wells the surface temperatures are as low as five degrees Celsius. Portland cement traditionally has inhibited set times at these very low temperatures. Ceramic cements set at temperatures below freezing. Quick setting times and the ability to penetrate formations and micro annuli make Microceramic an ideal solution for controlling unwanted gas and water movement," says Don Getzlaf, president of Cemblend Systems Inc.

DuraSeal is also designed for use in wells for lost circulation. This product uses the quick setting and short transition properties of ceramic cement to shut off lost circulation and water crossflows. DuraSeal has a variable particle size from >10 to 200 microns. The combination of a broad particle size and short transition time assures the material stays close to the wellbore and not mix with water crossflows or thief zones.

"Adjustable setting times and the ability to adapt to variable wellbore conditions make DuraSeal an ideal solution for controlling lost circulation and crossflows. DuraSeal is a two-component system and this unique feature allows for the binder to be mixed prior to the critical pumping operation. Once everything is ready on the rig the activator and binder are injected simultaneously. This process optimizes set time and pin points accuracy of final cement placement," says Getzlaf.

Getzlaf says DuraSeal was recently put to the test at one of Pioneer Natural Resources' shallow gas wells in northern Alberta. "Initially, the well had significant gas production but following an acid job, water production increased to 15 m3 per day and production dropped to uneconomic levels. Due to the high feed rate and the low wellbore fluid level, DuraSeal was recommended. After a 2 M3 squeeze, the ceramic cement was drilled out successfully and the water production was completely shut off.

Cemblend's new process called ReCeNT manages environmental concerns as well as simplifying wellbore logistics. "With the ReCeNT system, what comes out of the well goes back into the well. Drill cuttings are captured as a slurry, and when drilling is complete, a binder is added to the cuttings slurry and re-injected into the well along with an activator to cement the casing in place. The ReCeNT system substantially reduces water needs and simultaneously reduces both cuttings and mud disposal requirements," explains Marty Stromquist, CEO of Cemblend Systems Inc..

Stromquist says ceramic cement has a large tolerance for organic contamination and the ReCeNT technology utilizes drill cuttings and drilling fluids to provide hydraulic isolation to cement wellbores. This concept has the potential to provide a huge step toward changing how well waste is turned into a useful product. Currently, Cemblend is in the testing stage and is seeking regulatory approvals.

Portland vs. Ceramic Cement

The comparison between Portland and ceramic cement is Portland cement is not compatible with oil or organic materials. These materials typically slow or stop the setting process of Portland cement.

"We're seeing a trend where industry is drilling more with hydrocarbon-based drilling fluids and it is very difficult to stop contamination between the cement and these materials. Ceramicrete encapsulates organic material. Therefore, the organic materials have a minimal effect on the set time of Ceramicrete. This means Ceramicrete can be placed in some very difficult environments and still have a consistent setting," says Getzlaf.

Portland cement is also very dependent on density to gain strengths. However, strength is not always required during cement placement. Ceramicrete can have preset strengths independent of density which allows for high strength, lightweight cement slurries as well as low strength, high density slurries and vise versa.

Benefits

The benefits of Ceramicrete are the set time can be changed independent of temperature, the strengths can be changed independent of density, and the particle size can be changed independent of all other parameters. These three abilities give drilling operators total control of product selection independent of the wellbore temperature, permeability, or pressures.

Ceramicrete also has the added advantage of being able to 'activate on the fly'. "Because we are aggressive with the mix, it would be a concern to mix the ceramic in a pumping unit and have it set early on the truck. But because we activate the material as it is being placed, we have a lot more control of where the product sets," says Getzlaf.

One of the biggest benefits of using Ceramicrete is its ability to set hardening times independent of temperatures. What does this mean for drilling operators? "This means a shorter waiting time at the surface of the well. It means quicker setting cement can reduce the chances of gas migration through the cement. It means that once the cement is placed, it remains where it is placed and will not migrate away from the wellbore. It means the cement is less susceptible to mixing with either wellbore contaminants or formation contaminants," says Getzlaf.

Another major advantage of Ceramicrete is it can bond to steel, cement, formations, and even itself. "Ceramicrete's ability to bond allows for substantially improved performance in wellbores with drastic temperature changes and/or pressure changes. This 'stictivity' also aids in making sure the cement stays bonded to the wellbore formations as conditions change," says Getzlaf.

Ceramicrete is currently being used in the lost circulation and gas migration markets and Cemblend has plans to move its products into the thermal and CO2 environments. "These extreme environments are perfect for utilizing the technological attributes of ceramic cement of temperature and corrosion resistance and providing another tool in total wellbore management," says Getzlaf. OGN

Turboflo 46 keeps Interquisa running

Interquisa Canada, a supplier of Purified Terephthalic Acid (PTA) is based in Montreal. Construction of the Interquisa plant began in 2001 in the industrial area of Montreal East because Coastal Petrochemical of Canada, a producer of paraxylene (the raw material needed to make PTA) and the majority of Montreal's petrol refinery operations are based in the same area.

By 2003, the plant was fully operational. Interquisa is the second leading supplier of PTA worldwide. The Montreal plant is capable of producing over 500,000 metric tons of PTA a year. The Process PTA is used to make polyester for textile fibres, powder paints and Polyethylene Therephthalate (PET) containers. It is manufactured through an oxidation-based process. "We take air, which contains oxygen, and push it into the process through a huge five stage Demag turbine compressor equipped with a 30,000 HP engine," explains Luc Girard, Prediction Prevention Specialist, Interquisa Canada.

"The compressor doesn't provide ventilation to the plant; its only purpose is to feed the PTA manufacturing process. We only have one large compressor and it's the heart of the plant. It operates day and night, 365 days a year, with the exception of one week a year for maintenance. There's no back-up so if the compressor breaks down, the entire plant shuts down."

Reliable Lubricant

"We've been using Turboflo 46 in our compressor for two years now and we're very satisfied with its performance; everything has been working smoothly."

Turboflo 46 is designed to exceed the demanding service requirements of steam and gas turbines that drive electric generators. With exceptional oxidative and thermal stability, the Petro-Canada turbine fluid demonstrates exceptional resistance to fluid breakdown caused by air and high temperatures. This allows it to deliver excellent lubrication to bearings operating at high temperatures and exceptional performance over the entire life of the fluid. "Our compressor was made in Germany," continues Girard. "It's a top-of-the-line compressor. That's why it's so important that we use a lubricant like Petro-Canada's Turboflo 46 that meets the highest quality standards. For our plant, compressor reliability is crucial. We rely on the compressor to deliver a consistent amount of oxygen, and it must run at an optimal level to keep our electricity bill at a minimum. If the compressor has a lubrication problem, it consumes more power and we end up with a problem. That's why the compressor must deliver air at the lowest energy consumption level possible."

Performance Analysis

"Oil analysis of Turboflo 46 is a standard procedure for us. Because the fluid is used in our main compressor, we test it on a regular basis using Petro-Canada's Lubri-test used oil analysis program. We take samples to analyse the lubricant closely; we measure the quality of the lubricant and the compressor. Similar to a blood sample, if we find tiny particles that shouldn't be there, we know something is wrong.

"Through our frequent oil checks and analyses, we know Turboflo is performing very well. The independent laboratory confirms that Petro-Canada's lubricants are excellent, and the compressor is as efficient today as it was in the very beginning when it was brand new.

"We're looking to expand the oil analyses to several other machines we use in the plant, where it could lead to additional benefits.

"In addition, our plant uses other lubricants for smaller equipment, and we prefer not to deal with 40 different types of oil; that would be cumbersome. In response, Petro-Canada assessed our needs and came up with solutions to help simplify our operations and reduce the types of oil that we use in the plant." says Girard. OGN