

Geothermal Well Lost Circulation Solution Saves Time and Operational Cost

Case Study: Combination of PETCem-LD + ProNET Successful Applied to Form Impermeable Seal on pores and fractures Zone and Mitigate the risk of Lost Circulation during Cementing Operation in GW #01 Geothermal Well, East Java – Indonesia.*

Geothermal energy becomes an important source of energy and its importance will be increasing in the future. In fact, drilling geothermal well has many challenges in cementing of well casings due to high temperature and high pressure areas and also face the area is highly permeable and lot of natural fractures. The integrity of the formation ranges from poorly consolidated up to highly fractured, and the fracture gradients tend to be low. Consequently, the most common problem occurred in geothermal well is lost circulation. Often it is in a very large amount, either during drilling or cementing. If the losses happen during the cementing job, not rare that cement return cannot be found on the surface, especially when using conventional cement design. Light weight Cement slurry is used to overcome this problem. Besides has lower density than conventional tail slurry, it has good compressive strength compare conventional extended cement slurry to support the casing and to protect casing from corrosion.

Introduction

While drilling geothermal well, many geothermal operator experience problem circulating cement to surface because of depleted zones, a lot of natural fractures and unconsolidated formation during drilling. No rare a lot of Lost Circulation Material (LCM) Pills from Mud Company has been pumped but unsuccessful. One of geothermal operator in Indonesia needed High technologies methods, could be consider or applied to reduce lost circulation during cementing operation and get more cement column to support small hole drilling campaign

Challenges

Get the higher cement coulomb despite a lot of Lost Circulation Material (LCM) pills have been pumped, but losses soon recurred and unsuccessful to be cured before cementing job.

Solution

Use Light Weight Cement Slurry (PETCem-LD) plus Fine Fibrous Material (ProNET*) as advanced fiber technology to cure and control the losses.

Result

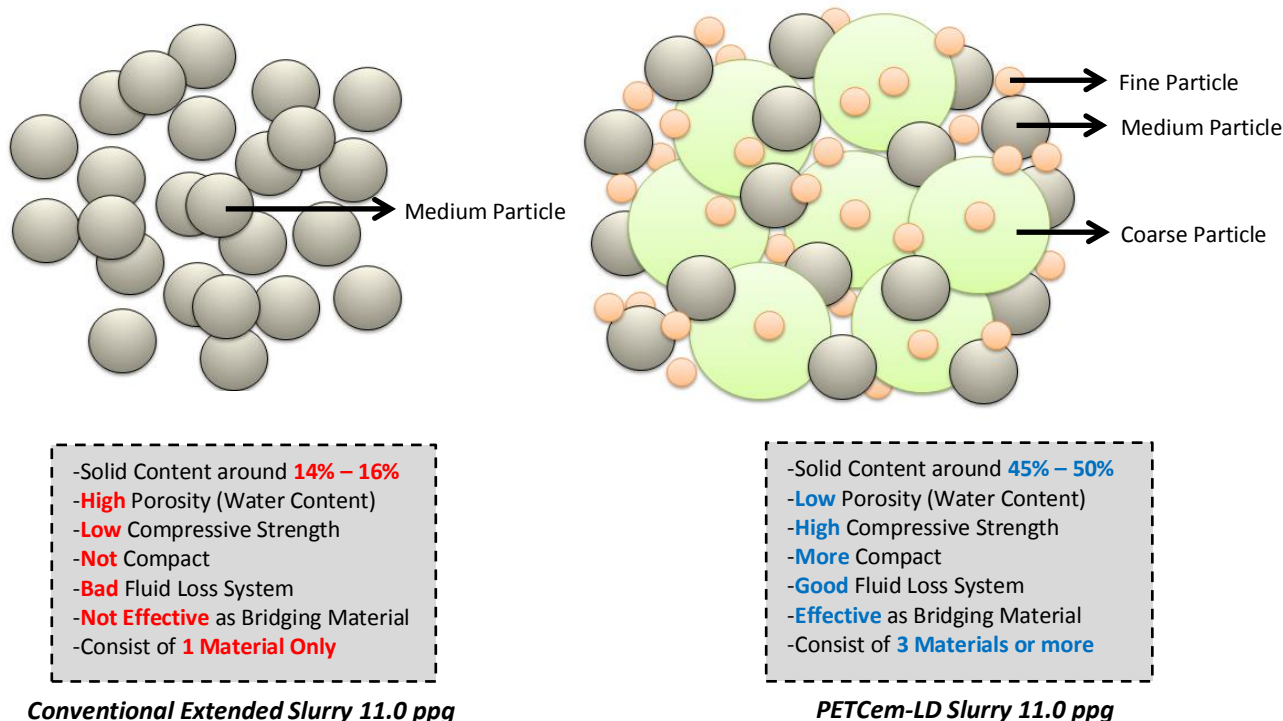
Achieved higher cement coulomb than expected on total lost circulation well with zero QHSE incidents.



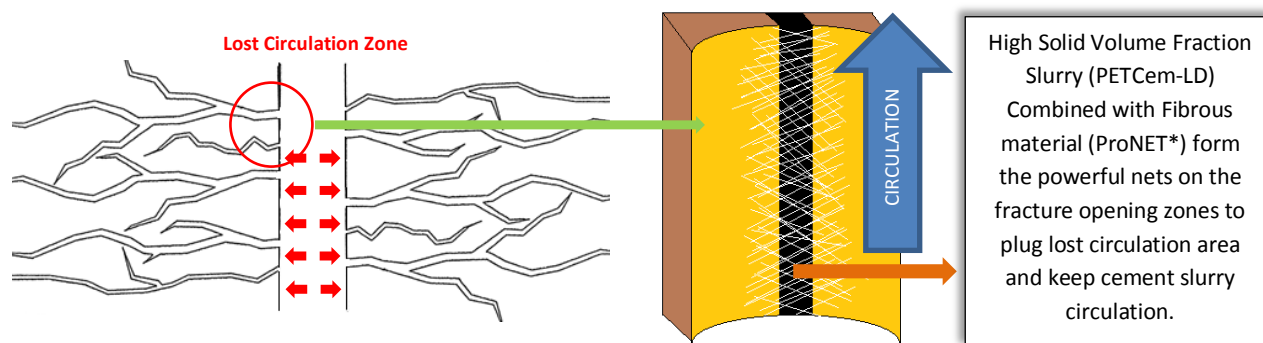
The land location of GW-1 location in South of Indonesia

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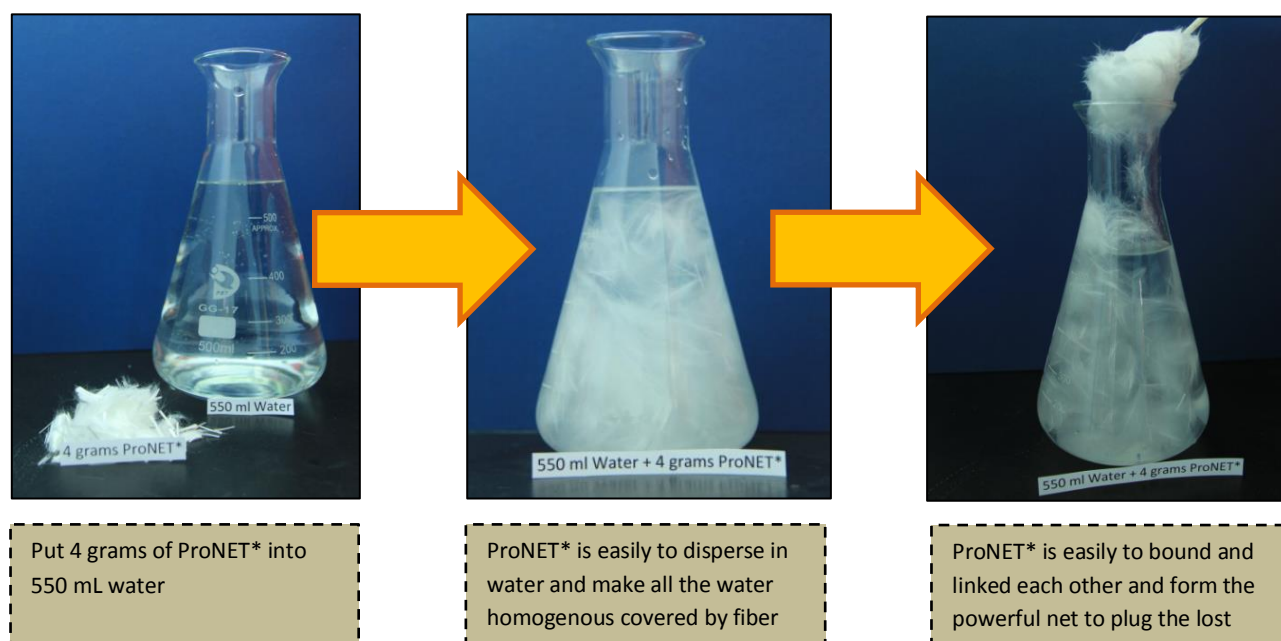
Geothermal wells always face fracture zone while drilling. Normally, losses are encountered in fracture zone and it will be more severe during cementing work because of cement slurry density is always higher than drilling fluid. Light weight cement slurry system has low density with high compressive strength and high solid content as solid bridging material, if ProNET* is added in this slurry system, it could help form bridging network system in the loss zone and subsequently restore the circulation and more powerful compare conventional slurry. ProNET* can be designed to be placed only at the loss zone and can be added directly to the cement mix tank or on the fly, without disturbing the desired cement properties. By adding these fibers into a cement system, there will be no extra cement to be prepared for anticipated losses. This will reduce cement waste and eliminate cement disposal cost.



PETCem-LD is light weigh slurry system to maintain hydrostatic pressure lower than frac pressure. The solid contain on this slurry system is higher than even on 15.8 ppg conventional cement slurry system. It is consist from Coarse, Medium (Cement) and Fine Particle to fill each other, reduce the space between particle and give bearing effect between particle. The more solid contain is the more effective and powerful as solid bridging material when ProNET* is added on this slurry system. In conventional cement slurry such as betonite extended slurry system, the solid content is only around 14% - 16% and a lot of space/ fluid matrix between particles, so it is not effective as solid bridging material. PETCem-LD is created with high technology system not only for effective as solid bridging material, it also has good fluid loss system (keep fluid in slurry to not penetrate to formation) and high compressive strength to support the casing compare conventional slurry system and also suitable for temp more than 230 degF. So it is the best solution for geothermal well during cementing operation.



Natural Fractures Formation in Geothermal Well and Spotted by PETCem-LD + ProNET* to get Circulation



Mechanism of ProNET* dispersing and forming the powerful net in water



Mechanism of PETCem-LD and ProNET* combination are;

1. **Disperse** : ProNET* is easily to disperse in slurry and make slurry homogenous while pumping.
2. **Bridge** : PETCem-LD form bridging system over ProNET* and make powerful net.
3. **Plug** : Combination PETCem-LD and ProNET* plug the fractures area.
4. **Sustain** : The powerful net can sustain and avoid slurry penetrate to fractures area.
5. **Circulation** : All the fractures area are covered by ProNET*, slurry keep circulation to surface.



Fibrous Material/ ProNET*

Light Weight Cement/ PETCem-LD

Coring's Sample from 5 ½ in Casing in GW-01 Geothermal Well

The result from GW-01 Geothermal Well, the status before cementing operation was total lost circulation, then pumped 11.0 ppg of PETCem-LD with combination 1 lb/ bbl of ProNET* and the result is top of cement was 2 meters below cellar.

Applications

- ✓ Natural fractures, induced fractures and weak zones.
- ✓ Cementing across potential lost circulation zones
- ✓ Cement slurry with solid content above 40%
- ✓ Loss circulation material during cementing operation
- ✓ Oil, Gas, Geothermal and CBM Well

Benefits

- ✓ Prevent lost circulation during primary cementing operations
- ✓ Saves time and rig's operational cost
- ✓ Low density cement with high compressive strength to support casing
- ✓ Prevent from gas migration
- ✓ Good cement bonding log (CBL)

Features

- ✓ Easier slurry preparation and execution
- ✓ The best cement properties compare other cement system at equivalent densities
- ✓ Applicable at temperature more than 230degF
- ✓ Higher solid content to protect cement aggressive against formation fluid
- ✓ Effective plugging delivered through cement slurry