Lost Circulation, Bridging Materials and the PPA

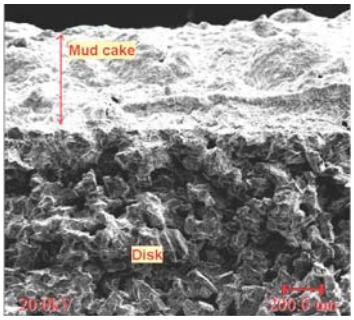
A discussion of the terms, technology, product application, and equipment relating to lost circulation and bridging materials.

Lost Circulation is the term used to describe the condition characterized by a lack of mud returning to the surface after being pumped down a well-bore. Lost circulation occurs when the drill bit encounters natural fissures, fractures or caverns, and mud flows into the newly available space. Lost circulation may also be caused by applying more mud pressure (drilling overbalanced) on the formation than it is strong enough to withstand, thereby opening up a fracture into which mud flows.

Bridging Materials are small-particle materials used to help prevent or eliminate loss of fluid from the well-bore to the formation, a condition (as described above) known as *lost circulation.*

Bridging Materials of a coarse, fibrous or flaky composition are used to form an impermeable barrier across a formation interface or perforation. Bridging materials are most commonly used when lost circulation occurs during drilling. They are also used in workover operations in preparation for killing a well when the kill fluid is likely to be lost to the perforations. The selection of an appropriate bridging material is more critical during workover operations since the barrier should be completely removed in preparation for placing the well back on production.

Some bridging materials are solids added to a drilling fluid to bridge across the pore throats or fractures of an exposed rock thereby building a filter cake to help prevent loss of whole mud or excessive filtration. Bridging materials are commonly used in reservoir drilling fluids and in lost circulation treatments. For reservoir applications, the bridging agent should be removable. Common products include calcium carbonate (acid-soluble), suspended salt (water-soluble) or oil-soluble resins. For lost-circulation treatments, any suitably sized products can be used, including mica, nutshells and fibers.



SEM photo showing no evidence of mud penetration into PPA disc

Bridging materials products are more commonly referred to as ***Lost Circulation Materials*** (LCM).

Lost Circulation Materials is the collective term for substances added to drilling fluids when drilling fluids are being lost to the formations down-hole. Commonly used lost-circulation materials are fibrous (cedar bark, shredded cane stalks, mineral fiber and hair), flakey (mica flakes and pieces of plastic or cellophane sheeting) or granular (ground and sized limestone or marble, wood, nut hulls, Formica, corncobs and cotton hulls).

The ***Particle Plugging Test*** is a test performed in a specialized filtration-type apparatus (particle-plugging apparatus) to determine the effectiveness of additives to help prevent fluid loss (lost circulation) into a permeable medium, and to evaluate the effectiveness of bridging materials.

PPA Cell with Aloxite Disc

PPA Cell

Permeability Plugging Apparatus
(PPA)

The ***Permeability Plugging Apparatus*** (PPA) is a specialized apparatus used in the particle-plugging test. The PPA is used to determine the ability of particles in the drilling fluid to effectively bridge the pores in the filter medium and, therefore, the ability of the mud to reduce formation damage in the reservoir. The apparatus consist of a high-pressure, high-temperature filtration cell that has been designed to operate upside down (to remove the effects of gravity) and to accept filter media of different permeabilities (machined stainless steel discs having measured holes or slots, which are used for higher temperature conditions, aloxite discs, which is a porous ceramic material or rock). The medium is selected to match the permeability of the reservoir to be drilled. The filter medium is at the top so that sediment will not affect the filter cake. Pressure is applied hydraulically from below.

For more information on the PPA or any of our many Fluid Testing Instruments, please contact Fann at the address below. Or visit our website: www.fann.com

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