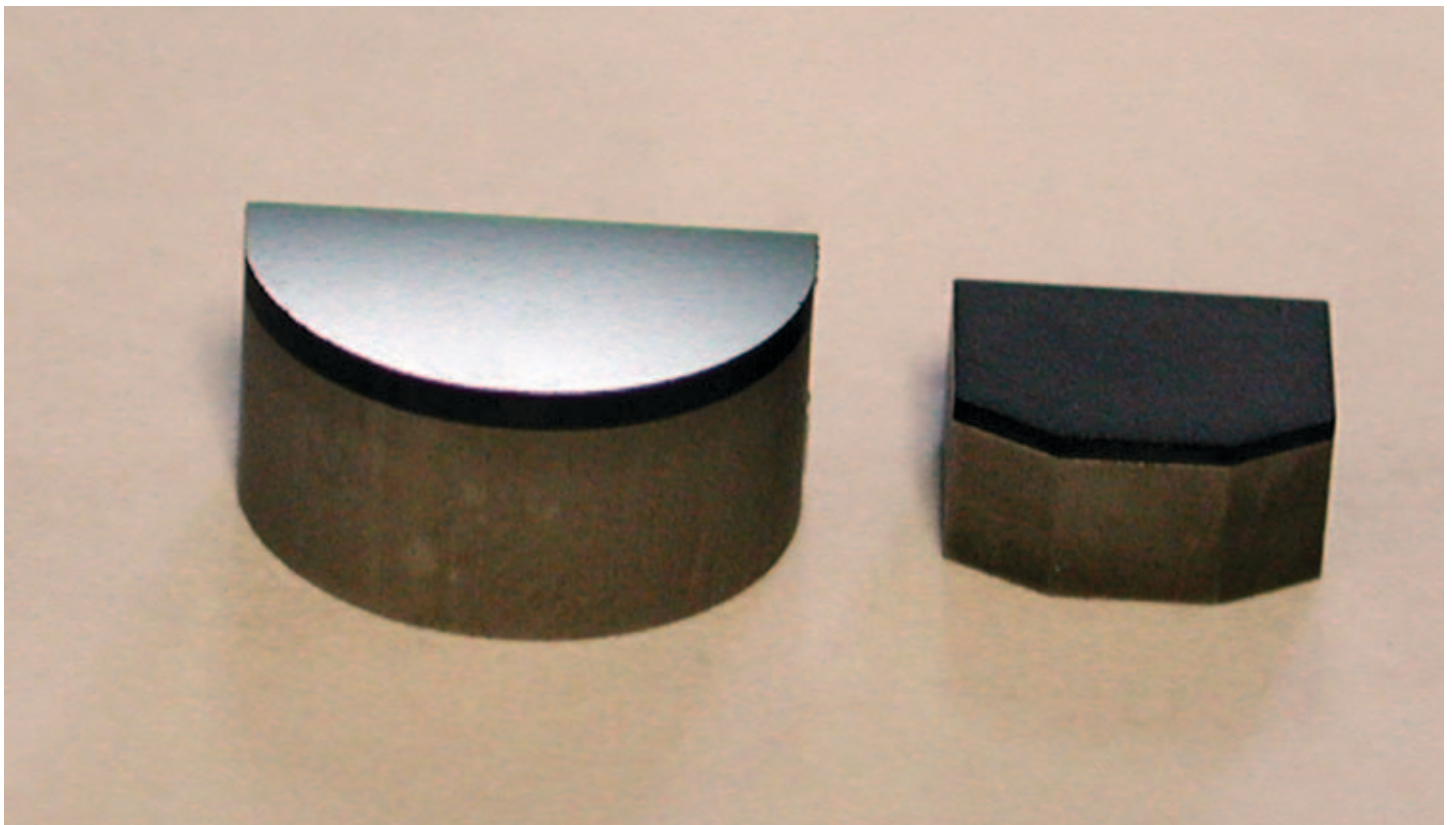


Tech Talk is a regular feature of *Concrete Openings* magazine, focusing on equipment, maintenance and operational issues of interest to concrete cutting contractors. Readers wishing to have a particular subject addressed can call or email CSDA with their suggestions at 727-577-5004 or rhitchen@concreteopenings.com.

Dry Drilling with PCDs

By Les Kuzmick and Mike Nelson



WHAT IS A PCD?

Polycrystalline diamond (PCD) is the product of sophisticated high-pressure, high-temperature technology, in which carefully selected synthetic diamond particles are sintered together in a powdered metal matrix. The random orientation of the diamond particles produces a high uniform hardness and resistance to abrasion in every direction. This polycrystalline diamond layer, which is very thin, is integrally bonded to the forward edge of a super tough tungsten carbide substrate, which provides strength and permits joining with other metals. The PCDs look like a tungsten carbide cutter tooth with a thin coating on the cutting edge, and are available in many different shapes and sizes.

Consistency of manufacturing parameters is a major advantage of a PCD. The structural integrity of a PCD produces a much more aggressive cutting action than diamond-impregnated bits in a variety of applications, including dry drilling brick, block, stone and concrete.

APPLICATIONS

PCDs have been widely used in many industries as a component for precise machining tools, and this technology has also been adapted to the sawing and drilling industry. Applications that previously could only be wet drilled can now be drilled dry with uniquely designed PCD core bits. Drilling dry provides cutting contractors with the opportunity to drill old

buildings, historical sites and other sensitive environments that require structural improvement. These types of locations cannot stand up to slurry migration, contamination and structural compromises that can result from wet drilling. Since the introduction of PCD technology to the sawing and drilling industry, numerous high profile deep drilling projects have been accomplished all over the world.

Dry drilling with PCD technology opens up a significant service sector market by making these projects possible. If it were not for the use of PCD products and the applications of advanced cutting techniques, there is a very high probability that a number of projects may never have been undertaken.

Diamond tools utilizing PCD technology can be expensive. However, these products can potentially produce cutting rates and segment life equal to, or greater than, wet cutting tools. Combine this with the fact that contractors now possess tools that will help them successfully complete a wider variety of jobs, some of which they would otherwise not have been able to complete, and it is clear that this can be a potentially very profitable investment.

TECHNIQUES

Dry drilling with PCD core bits must be undertaken with respect to a number of techniques and factors that influence the success or failure of the project. Drilling speed, debris removal and tool temperature are a few of the factors that have major impacts on performance and tool life.

DRILLING SPEED

Dry drilling requires a much slower rpm than conventional wet drilling. Since the cutting action of a PCD bit can produce much coarser debris, a slower rpm allows for debris to be cleared more efficiently. Also, a reduction in heat buildup from operating at a slower rpm allows for greater production and reduced wear rates.

Recommended rpm Speeds:

1- to 1.875-inch core bit diameter = 100 to 500 rpm

2- to 6-inch core bit diameter = 50 to 200 rpm

Larger than 6-inch core bit diameter = 50 or less rpm

PENETRATION

Dry drilling requires moderate and steady pressure on the bit with reduced pressure through steel. PCD core bits are very aggressive cutters, even in material like steel that can dull diamond segments. The driller must be prepared to quickly back off feed rates when encountering steel. Periodically, drilling penetration should cease completely to help the bit to cool and allow debris to clear from the cut.

When a drilling operation encounters very hard, non-abrasive materials or fractured non-homogenous debris conditions, the aggressive cutting action of PCD bits can cause chatter that slows the drilling process. Changing the PCD bit to a segmented core bit specially designed with heat-resistant silver solder, or laser-welded dry drilling segments, can help the penetration rate and reduce chatter through such conditions.

DEBRIS REMOVAL AND COOLING

The removal of drilling debris and the cooling of the bit are critical to the success of any dry drilling job. If debris is not properly removed or the bit is not sufficiently cooled, the wear rate of the bit will greatly increase and the bit will jam in the hole or burn up. To

ensure proper debris removal and sufficient bit cooling, a combination of compressed air going in the hole and a dry vacuum to clear debris coming out is required. The compressed air is introduced just like water is introduced in the wet drilling process. The air circulates and removes the debris, carrying it back up to the surface. Once debris reaches the surface, common debris "catchers" essentially perform the function of containment just long enough to enable a dry vacuum to completely remove the debris. Some debris catchers can be as simple as an inverted plastic bucket with a hole big enough for the bit to go through, and a hole in the side that allows a dry vacuum nozzle to be inserted to remove the debris. Regardless of the process used, it is crucial that debris is removed and the bit is cooled for the drilling to succeed.

Dry drilling is a specialized application that requires an experienced driller with the right equipment. Equipment should be in good working order and the operator should have the ability to overcome drilling obstacles as they come up. Changing conditions can cause heat buildup and blockage if not handled in a timely and correct manner. There is no substitute for experience when handling the challenges of each job.

The sawing and drilling industry has a viable tool to dry drill in many applications and environments that previously would not have been possible. PCD technology has changed the way cutting contractors assess jobs and is allowing sawing and drilling professionals to apply their trade to tougher materials.

Les Kuzmick is the chief financial officer of K2 Diamond, based in Torrance, California, and Mike Nelson is the vice president of sales and marketing for the company. Both have many years of experience in the sawing and drilling industry and Nelson currently serves on the CSDA Election Committee. They can be reached at 800-539-6116 or mike.nelson@k2diamond.com.