PARADIGM® "IN GRINDING, LESS IS MORE"

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In the world of industrial manufacturing your customers continue to demand tighter tolerances, better finishes and shorter lead times all at a lower cost than ever before. To help you conquer these seemingly insurmountable requirements, modern machine tools offer enhanced rigidity, increased horsepower and better coolant delivery among other improvements. Whether you have already purchased or are looking to acquire one new machine tool, or ten, your goals are the same:

- Higher productivity
- Improved quality
- Tighter tolerances
- **LOWER COSTS**

Advances in machine tool technology require corresponding advances in the grinding wheel. A generic resin bonded super abrasive wheel may have worked OK on that old grinder in the corner of the shop making 5 piece orders here and there but the new material your customer is demanding in 500 pieces per month is going to sink you. The future of grinding wheel technology is designed to take advantage of the improvements in machine tools to maximize your grinding performance.

Existing super abrasive grinding wheels use a fully dense bonding system. The result is a grinding wheel with excellent abrasive retention but zero porosity. The abrasive retention allows the super abrasive wheel to maintain form longer, increase the truing interval and increase the total life of the wheel life. However it also means that all of the benefits of porosity are lost on the grinding system.

BENEFITS OF POROSITY: lowers cutting forces, lowers chip to bond and bond to work piece forces, efficient chip removal from the grind zone, reduces loading, brings coolant into the grind zone, reduces or eliminates stick dressing, Online true-able

Paradigm® has solved this problem with a new bonding technology that enables high levels of controlled porosity while still maintaining high grain retention. The combination of grain retention and controlled porosity result in a product that can be fine-tuned to specifically meet the needs of your application.

Customers using this new bond technology have noticed a great deal of ease in profile truing on or off the machine! Paradigm® has the ability to profile online using diamond rolls and trues much like a vitrified CBN or vitrified diamond product. Due to its porous nature, this technology does not require stick dressing on tools less than ¾ inch diameter. On the larger tools, stick dressing may be required but the interval between dressing can be increased by 2X. Following are some examples of the success this new bond technology has had across many different diamond applications.

CASE STUDY 1: PERFORMANCE FLUTING ON 6% COBALT ENDMILLS

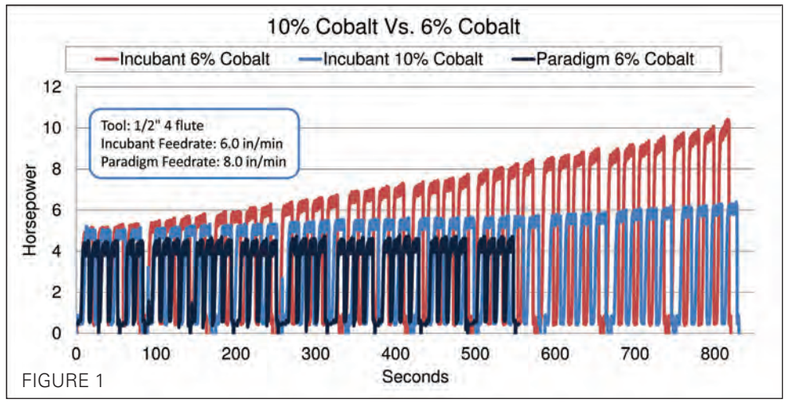

FIGURE 1

FIGURE 1 illustrates how effectively it is able to grind 6% cobalt round tools. In this test, ½"- four flute tools were ground in both 6 % and 10% cobalt. The 6% cobalt material tends to embed itself onto the wheel causing a loading effect. This is why the spindle load increases by 2X for the incumbent product. Paradigm® not only grinds this material without loading but is also able to do it 25% faster!

CASE STUDY 2: PERFORMANCE FLUTING ON 10% COBALT ENDMILLS

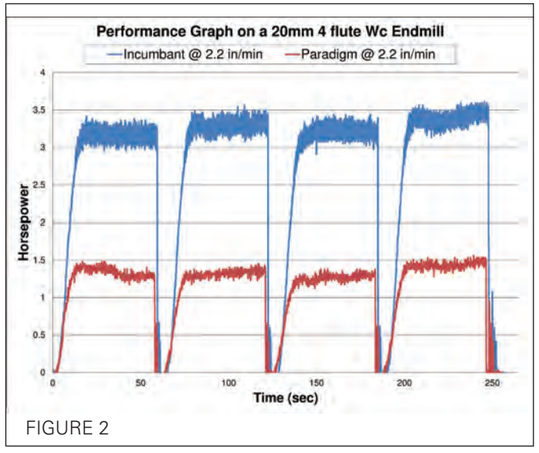

FIGURE 2

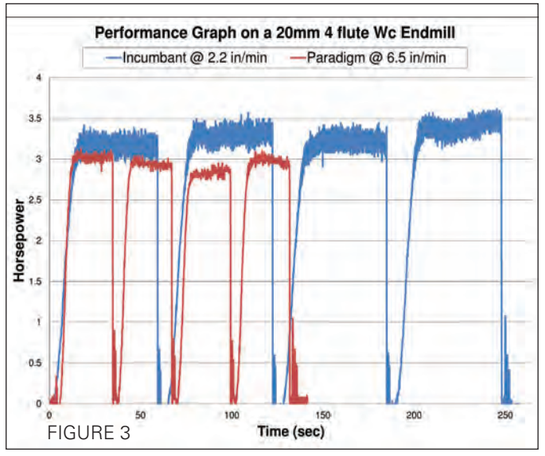

FIGURE 3

FIGURE 2 is a head to head test on a typical 10% cobalt 20mm carbide end mill. Based on the spindle load, it is evident that Paradigm® is much more efficient and free cutting than the incumbent wheel as it grinds at approximately 57% lower spindle load!

IN FIGURE 3 the test was continued. Paradigm® was able to grind 66% faster and still retain spindle power lower than the incumbent.

CASE STUDY 3: PERFORMANCE GASHING ON 10% COBALT ENDMILLS

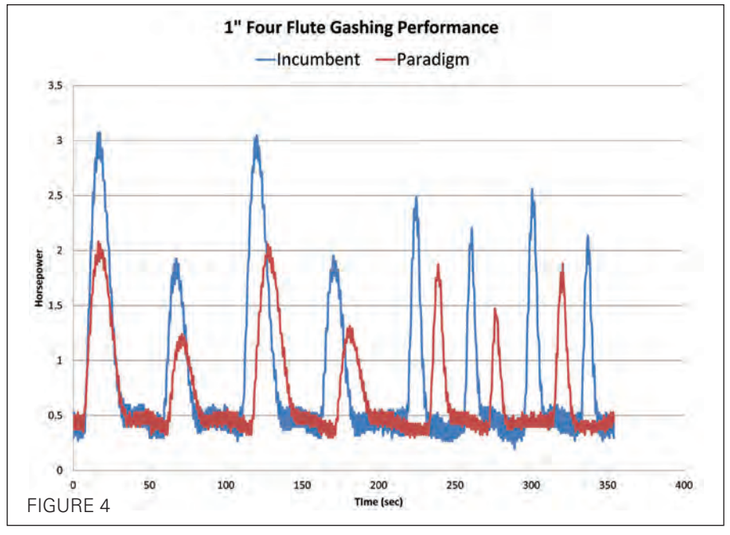

FIGURE 4

IN FIGURE 4, the incumbent data series represents the 5th tool without stick dressing while the Paradigm® data series represents the 10th tool. Testing has shown that on ¾" end mills and smaller, Paradigm® does not need to be stick dressed when Gash grinding. As seen in fluting, Paradigm® resists loading due to its porous structure.

CASE STUDY 4: PERFORMANCE FLUTING ON 10% COBALT DRILLS

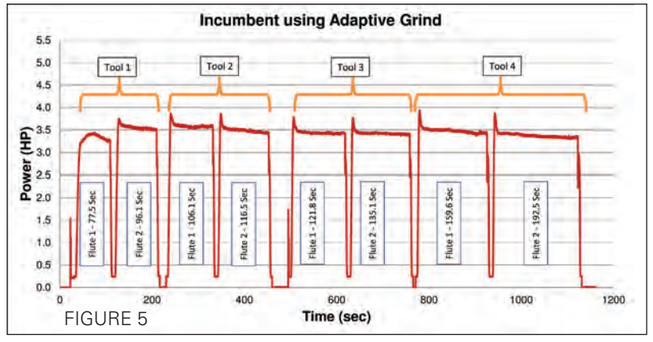

FIGURE 5

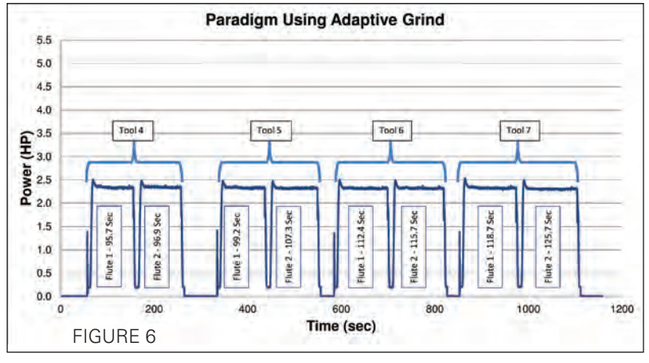

FIGURE 6

In this drill flute grinding test, adaptive grind mode was used on a 5-axis CNC machine. This feature monitors the spindle load and maintains a spindle load percentage specified by the customer by slowing the feed rate thus increasing cycle times. As seen in figure 5, the incumbent wheel activates the adaptive grind mode after the first flute of the tool. By the 4th tool ground, the cycle time increased by approximately 60%! Figure 6 shows tools 4 through 7 ground with Paradigm®. The 7th tool is at 125.7 seconds/flute which is better than the incumbent wheel's cycle time on the 3rd tool. With Paradigm® the cycle time has changed only 38% after 7 tools and was able to grind maintaining this rate through the night completing the job!

CASE STUDY 5: PERFORMANCE CARBIDE INSERT GRINDING

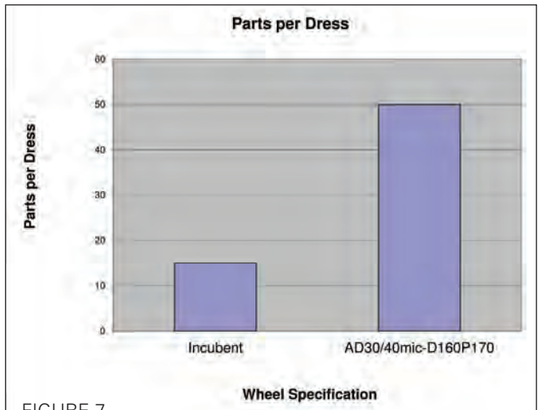

FIGURE 7

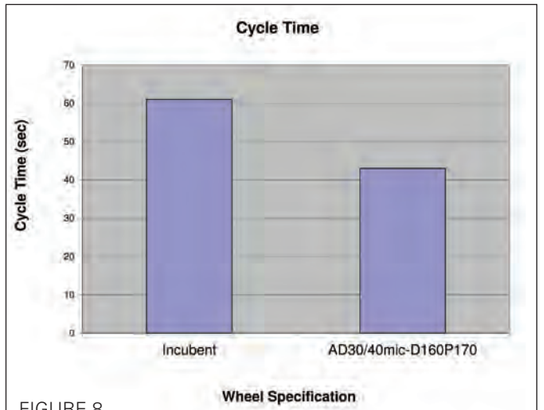

FIGURE 8

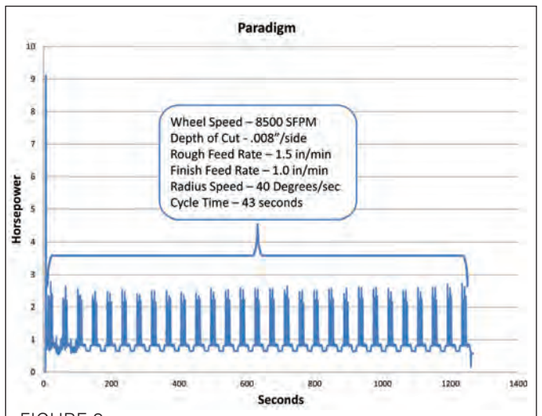

FIGURE 9

In the grinding of carbide inserts and thanks to the porosity of this bond technology, customers have seen parts per dress increase by as much as 330% (figure 7). Increased stock removal rates are also possible by as much as 44% (figure 8). Grinding power on carbide inserts is also very stable and consistent and in return produces consistent size control and finish. Figure 9 is shows that consistent power and high feed rate are obtainable.

Paradigm® is available in all standard sizes and shapes for the manufacture of carbide and ceramic round tool and cutting inserts. Additional applications include gear hobb grinding, HVOF spray coating, punch and die grinding. Materials include tungsten carbide, aluminum oxide, silicon nitride and other ceramics and cermets.

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