

# WHY WPC?

By Mike Kojima, Engineering Editor MotoIQ.com

In this present struggling economy, anything that adds cost to an engine build is a hard sell when engine builders are struggling to stay in business and racers search far and wide for sponsors to fund their programs. However, now more than ever, it is time to use value added processes that offer significant gains in both performance and longevity to your customer engine builds. WPC is such a process.

## What Is WPC?

WPC is not a coating; WPC is a metal improvement process, developed in Japan. WPC is a well kept motorsports secret that is used extensively at high levels of the sport, such as JGTC, MotoGP and WRC. Recently WPC has been gaining popularity in North America in venues such as Pro Stock drag racing, IRL, ALMS and NASCAR. WPC is also gaining acceptance from the OEM auto and motorcycle manufacturers such as Honda and Yamaha as a better performing alternative to coatings to enhance wear resistance, extend service life and to reduce friction.

WPC is very secretive about their exact process but we have been able to glean a few important details from indirect observation. WPC is closely related to shotpeening except it is done in a very different manor. Like shotpeening, WPC involves impacting a part with spherical projectiles to produce surface compressive stress, plastic deformation and grain refinement. Like shotpeening this action greatly improves fatigue strength and stress corrosion fracture resistance. However WPC differs from shotpeening in that the peening media is several orders of magnitude smaller, much harder and the impact velocities are much higher.

Although WPC will not divulge exactly what their media is made from, it resembles baby powder to the casual observer. We conjecture that the material is some sort of ultra hard ceramic whose dimensions and roundness can be precisely controlled like silicon nitride. These spheres are in the low micron range size wise and the impact velocities are near sonic in speed. We also feel that sometimes metallic additives such as zinc, tin and molybdenum disulfide are added to the mix to add some anti-galling lubricity or extreme pressure characteristics to the surface. At high velocities, the additives are probably inter-granularly incorporated into the surface of the metal at a molecular level, making their effects permanent and long lasting. We asked the folks at WPC to

confirm this but they sort of just smiled and said nothing.

We can say that WPC, however secretive they were about the exact process was generous in showing us reams of empirical test data to back up their claims; much of it was from some of their OEM and high end racing customers that we had to swear not to reveal. Coming from an OEM and Motorsports engineering background, we can assure you that these tests are very thorough and repeatable.

## Why WPC?

WPC offers many advantages over shotpeening. Due to the small low mass projectiles and high impact velocities, WPC produces a higher amount of compressive stress and an increase in the degree of grain refinement to the base metal over shotpeening. The velocities are so high that in addition to shotpeening like grain refinement via cold working, there is also a melting and quenching phenomena going on at a very micro level as well. The result is an extremely fine grained, slip plane less nano crystalline structure with a high degree of surface hardness formed over the surface of the part, unlike shotpeening which has only a slight effect on surface hardness and strength. Because of this ultra fine grained surface, WPC has superior fatigue strength gains and stress corrosion fracture resistance to shotpeening. Due to the small mass of the media, the affected zone of WPC treatment is less than 0.001", much shallower than shotpeening.

Mostly because of the smallness of the media, WPC does not affect the dimensions of a part. WPC does not damage delicate machined surfaces. WPC can be applied straight to areas where dimensional control and surface finish is critical, such as bearing bores, pistons, cylinder bores, camshafts, crank fillets, valve bodies, cam followers, valve stems, valve springs, seal surfaces, axle splines, CV joints etc. Due to the light mass of the media, WPC can also be used for fragile dimensionally critical parts such as

piston rings and even plain bearings. Every metal engine part can benefit from WPC treatment without fear of damage.

Another big advantage that WPC has is a big reduction in friction. The WPC process leaves an extremely fine dimpled surface on the treated surface. The WPC media is so fine that the surface dimpling cannot be seen with the naked eye and can only be observed with a microscope. The micro dimpled surface is one of the secrets to why WPC works so well. WPC's micro dimpled surface helps reduce friction in three ways. First the dimpling helps maintain an oil film which reduces metal to metal contact. Second the dimpled surface helps reduce contact area in general to reduce friction. Third WPC creates a slippery hard surface with anti friction and extreme pressure materials embedded into it.

These properties make WPC an excellent process for treating cylinder bores, pistons, rings, wristpins, gears and anywhere reduced friction can help. Test data by a major OEM manufacture has shown that WPC treatment of pistons can reduce friction and wear of pistons by two fold over the best skirt coatings. Recent testing by a major forged performance piston manufacture has also shown WPC to be more effective to the reduction of skirt wear and scuffing over any coating presently on the market.

WPC treatment of pistons, cylinder walls and rings has shown to provide tremendous advantages in friction reduction, life between rebuilds and ring seal. Many race teams have documented double the amount of time between having to rebuild or freshen engines. This is alone a huge cost savings for today's cash poor budget strapped race teams.

WPC treatment of plain bearings has also shown to be very beneficial. Even though bearings are made of soft metals such as aluminum, lead, tin and zinc, they can be WPC treated with no change in dimension. The treated bearings show a reduction in



friction and an improvement in fatigue strength to where their load bearing capacity has improved up to 20 percent!

WPC treatment has proven to work well on solving problematic transmission issues as well. WPC can obviously be applied to the gears, syncros, splines and shafts. It can also be applied to cases and housings. WPC has found that some cases of transmission gear failure in some cars can be traced to flex in the transmission case which allows the gears lash to change under load. WPC treating the case reduces this and transmission life is improved. Take note of this for your transfer case EVO owners. DSM owners and builders of the WRX and Sentra SE-R should pay attention here as well. Transmission and differentials treated with WPC run cooler and shift smoother with less friction and power loss.

An unusual property of WPC is that it is sometimes difficult to see horsepower gains directly as dyno test results. WPC, in addition to helping with power production also helps improve dynamic response, something that is difficult to measure on a dyno.

#### **WPC advantages**

- Greatly improves fatigue strength and stress corrosion fracture resistance
- Improves surface hardness and surface finish for increased strength, reduced friction and improved wear resistance
- Increases in horsepower and engine transient response are seen from friction reduction and improved ring seal.
- Micro dimpled surface will not harm and works well on finely finished machined areas such as seal contact areas, bearing bores, bearing seating surfaces, crankshaft fillets and other delicate areas
- Does not distort close tolerance parts
- Does not damage soft or fragile parts
- Not easily visible to the naked eye
- Can take the place of several different processes to save time and money, for instance shotpeening, then coating
- Is compatible to and enhances the advantages of Ion Nitriding, Cyro Treatment, REM, Mikronite, DLC and other high performance post treatments
- Treated assemblies run cooler
- Can double the service life of a racing or high performance street engine
- No significant drawbacks that we can think of!

#### **WPC Disadvantages**

- It's not free!
- The process is only available in Southern California; parts to be treated must be shipped. However WPC has good service and fast turnaround.
- Parts need to be disassembled and cleaned thoroughly before and after treatment



- Process is secret so you just have to trust them!

#### **A real life example of WPC at work**

Compass 360, a leading Koni Grand Am Cup team ran two Acura TSX's in the ST class. Both cars were equally prepared with one difference; one car used the WPC process extensively in its engine build. Billy Johnson, one of Compass 360's drivers related to us that the WPC treated car was consistently faster all season.

The team noted the following gains in performance and reliability over the course of the season:

- Higher horsepower
- Faster acceleration
- Better wear on engine parts, the treatment doubled engine life greatly reducing maintenance costs
- Strengthening of parts, failures were reduced to zero in connecting rods and transmission ring gears and counter shafts, these were high failure parts in the past
- A slightly leaner air/fuel ratio could be run with no loss in power meaning better fuel economy a big advantage in endurance racing.

#### **WPC Saves Money!**

We use WPC extensively on our race and project cars and found these processes to save us many dollars in preventing parts failures, reducing maintenance and lowering our DNF rate in racing. Consider this; although many of us racers would like to think we are something special, the cold truth is that maybe only 1 in a thousand of us really is. Most of us are either club racers or semi-pro racers running our own programs largely out of our pockets. Sure we might be the local track hero, we might get in the magazines or TV occasionally, we may have

parts, fluids and tire sponsors but the bulk of labor, transportation and crew costs come out of our pockets. If we break, we don't have a huge, well trained crew and transporters full of spares to make things right again.

We did probably have to spend several hundred bucks on entry fees, more hundreds on gas for our tow rig, more hundreds on food and lodging for our crew, even it is our buddies doing it for free and we all sleep on the floor of our single motel 6 room. To prep the car took many hours of time, time away from other duties, time away that annoys wives, girlfriends and maybe your day jobs boss. Maybe your race time takes up your precious vacation time. These are all important costs.

Let's say you break on the morning warm-up on the first day of your race weekend. Not you? Well you gotta admit that on a typical race weekend this happens. It has probably happened to you at one time or another. If your problem was bad and puts you on the trailer, look at all of the wasted time and money. That's no fun. Even if you love mechanical work, there are probably better things to do with your time off than R&Ring and rebuilding components.

For the engine builder, WPC is a way to give your customers an advantage in both performance and durability saving your customers hard-earned money and improving your customer satisfaction. It can also be a good profit center option for your business.

WPC is a great, inexpensive way to improve reliability, reduce maintenance and improve personal relationships. WPC can save marriages! (well that part is up to you but we can say that WPC is good stuff!)