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# metal powder REPORT

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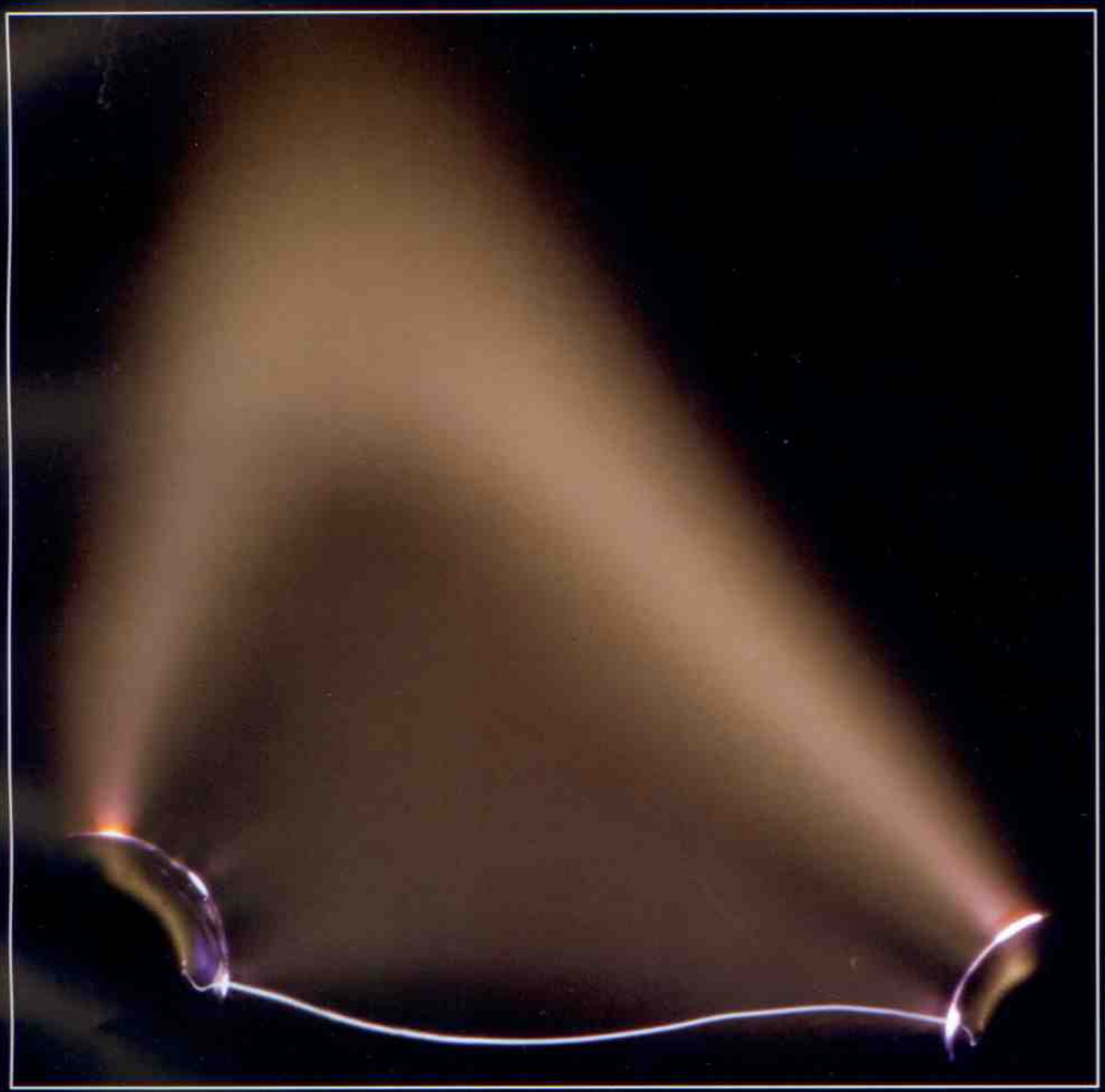

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# Rotary or double cone? Take your pick for quality

Rotary batch blending is said to improve quality and standards in powder metal blending and boost parts' green strength compared to conventional double-cone techniques. It's a claim that some may find controversial...

Nestled in the heart of Ridgway, Pennsylvania, which claims the title "powder metal capital of the world", Allegheny Blending Technologies (ABT) specialises in custom blending of ferrous and non-ferrous powder metals that are sold to moulders of powder metal parts. These blends of iron powder and additives (copper, nickel, graphite, manganese sulphide and dry lubricants) play important roles in products and equipment. In the US automotive industry, nearly every car has about 12 kg of powdered metal parts ranging from timing gears to anti-lock breaking mechanisms. Powdered metal parts are also found in the drive gears and motors of lawn mowers, snow throwers, and other gardening tools, as well as in home appliances such as washers and dryers.

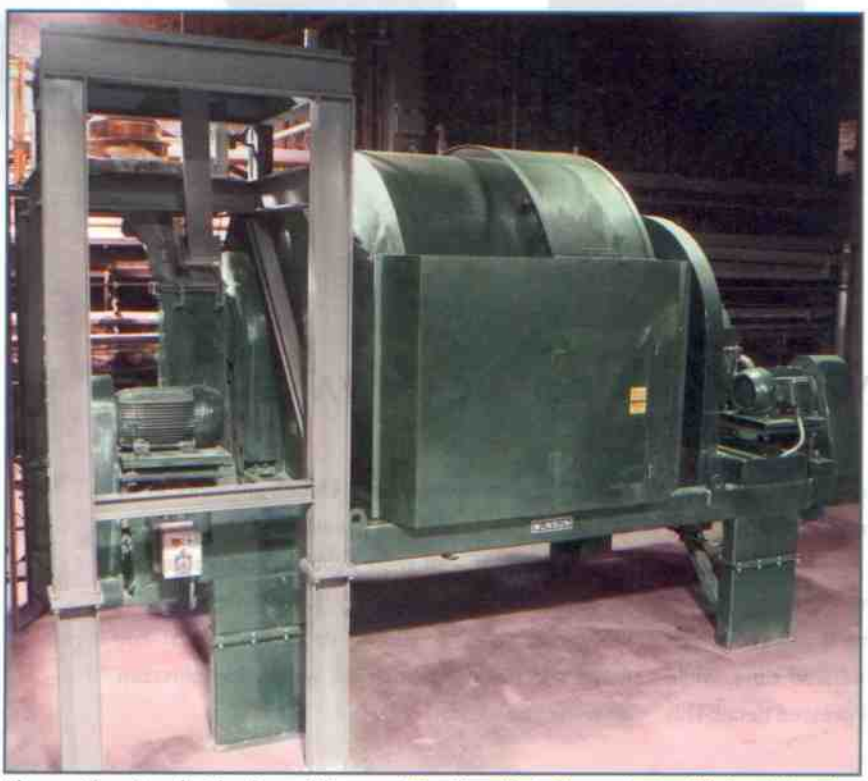

*Figure 1. The rotary batch mixer achieves 100% uniformity in three minutes. It's 'gentle' action helps to preserve the green strength of powder metal.*

ABT have been blending custom powder metal batches from 227 to 4536 kg since 1997. Four double cone blenders handle the 227 kg, 1134 kg, 2268 kg and 4536 kg batches. A 12 kg capacity double cone blender handles samples. "With double-cone blenders, we find it's best to match the load to blender capacity for optimal homogeneous mixing," said Paul Reed, president of ABT. "Under loading a double-cone blender reduces mixing action efficiency. The material tends to roll around in the barrel rather than blend thoroughly together."

When customers requested blended batches of 20 412 kg truckload lot sizes, rather than purchase another double cone blender, Reed chose a Munson 700-250 HD rotary batch mixer for high bulk density materials. "A double cone blender for this capacity would not meet our needs," said Reed. "Higher weight loads increase the friction the powder particles experience during blending, affecting the final properties of a mix. In addition, double-cone blenders of that capacity are tall, requiring a ceiling height of more than seven metres."

The rotary batch blender is a physically compact piece of equipment. " I had also heard that rotary blenders' mixing

action is more gentle than that of double cone blenders and of shorter duration," continued Mr Reed. "These features will reduce particle rounding caused by friction between the metal powders, maintaining our high quality product."

In addition, the rotary batch system can be under loaded down to 10 per cent with no effect on batch uniformity or cycle times, handling batches from 20 412 kg down to 2 041 kg with equal efficiency.

The blending process begins when iron powder arrives at ABT in loads consisting of 2268 kg palletised cardboard boxes. Forklifts load the boxes into a powder dumper, which tilts and dumps the contents into a steel hopper positioned above a fine-mesh screener.

Additives arrive in either small bulk containers or paper sacks and are poured into individual hoppers that rest on coarse mesh screens. "We sift everything prior to blending," said Reed. "We ensure contaminants such as wood slivers from the pallets or bits of cardboard or plastic do not enter the mix, as foreign material could compromise the finished powdered metal part."

After screening, three floor scales weigh the powders before they are loaded into the blender. The iron is weighed on a 4536 kg scale in 2268 kg loads. The 227 kg scale weighs the nickel and copper additives. A 91 kg scale provides the greatest accuracy needed to weigh graphite and dry lubricants.

The iron powder is gravity fed one box-load at a time from the steel hopper into the blender. Before the last 1134 kg load is added, the hopper containing the additives is raised into position by a forklift for gravity discharge into the blender.

The rotary mixer consists of a horizontal, rotating drum with a stationary inlet at one end and a stationary outlet with a discharge gate at the other. A self-adjusting face seal at the inlet allows dust-free operation. Internal baffles (mixing flights) and lifters create a four-way mixing action that tumbles, turns, cuts and folds material throughout the filling, mixing and discharging phases, achieving 100 per cent batch uniformity and preventing the separation of ingredients of varying particle sizes.

The mixer can achieve 100 per ecnt batch uniformity in three minutes, but ABT mix 20 250 kg loads for about 15 minutes depending on the properties required for specific powder metal mixes. "The rotary

*Figure 2. Relatively compact in itself, the blender can handle batch load from 2000 kg to 20000 kg with equal efficiency.*

*Figure 3. Once blended, the load is discharged to the hopper for onward transport to packing and dispatch areas.*

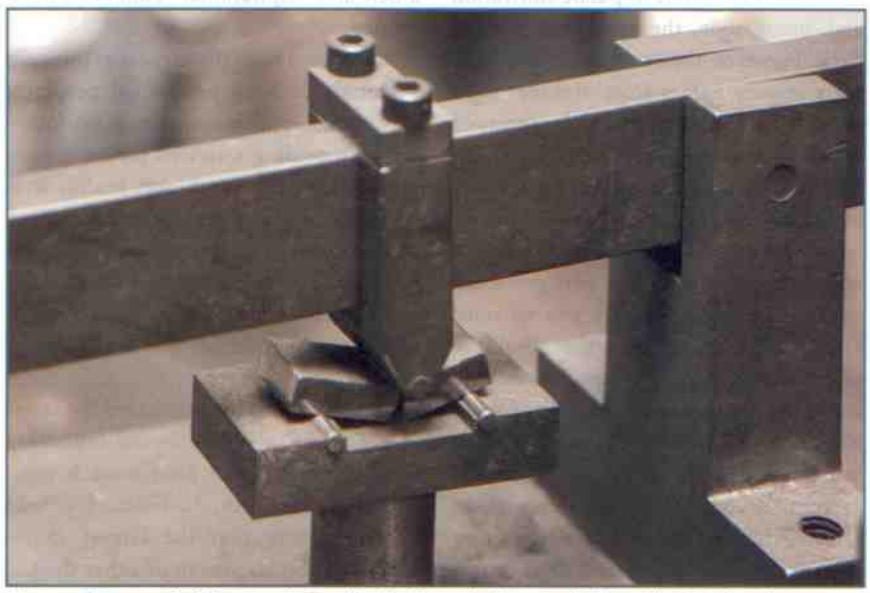

*Figure 4. The proof of the powder quality is shown by the results from the test rig where green test bars are stressed to breaking point.*

batch mixer saves us time and ensures a quality product," said Reed. "A double cone blender for this size load would take more than 50 minutes to blend because the material tends to roll around rather than mix together. Plus, the long blend time builds more heat within the mix. When the mix gets hot, then you know you're rounding the particles, reducing the mixture's green strength."

After loads are mixed and the plug gate is opened, the flights and baffles in the rotating drum elevate and discharge the entire contents of the batch, with no residue, into hoppers that are transferred to the packaging area. "We found that if we let the blender run for a few minutes after full discharge, only minute amounts of dust remain," said Mr Reed. "If we stop the blender too quickly, maybe one-quarter to one-half kilogram of material remains. We use a shop vacuum to remove any remaining dust, but even then, clean-up is quick and easy."

Uniformity of powdered metal blends is crucial to the performance of the finished part. "Even though our customers' parts typically weigh only a few grams to 7.7 kg, they need repeatability and consistency to meet tight dimensional tolerances," he added, "so they see the benefits of our homogeneous product."

Sampling ensures homogeneity, but it is done primarily on new blends to obtain blending times. "Once we've mastered a blend's mix and mixing time, there's no need to sample. But, if a customer has an order for a specific feature in a blend, such as apparent density, we will sample to ensure we meet that specification," said Mr Reed.

"Most parts manufacturers get their metal powders preblended now, and no longer do it themselves so green strength is something we measure for our customers," continued Paul Reed. "We mould test bars of green metal that are about 38 mm long, 13 mm wide and 6 mm thick and break them in a tensile tester to assess a blend's strength. We have found that green parts from material blended in the Munson unit have a higher green strength than parts moulded of material from double-cone blenders."

Paul Reed says, "We're providing a more consistent, homogenous, less degraded material; that's all a benefit for our customers. They like what they're getting from us."

# What's in a name, or alphabet soup?

There was a time before 2001 when company names, even when newly minted, meant something. Then came the disaster of the rebranding of the British Post Office as Consignia. All the attempts by blow-hard branding "experts" to justify the change (and the cost thereof) could not turn away the tide of public vilification and, pretty soon, the name was changed back. However, the "tradition" of plucking company names from alphabet soup persists, for how other would the agents of branding change make a living?

The technology sector has been active in this regards, not always for the worse. So when the UK's Defence Evaluation and Research Agency was part privatised in 2001, the spun off part was renamed QinetiQ. The name had the advantage of at least having an association with energy (if you ignore the niceties of spelling), and therefore with technology. It found broad public acceptance, and when in turn, it span off companies such as QinetiQ Nanomaterials Ltd (QNL), they too were quickly assimilated. QNL made, among other things, nano-metal powders by a plasma process.

But what's been spun off once can be spun off again, and so it was last year that QNL landed in the alphabet soup when it was one of seven businesses transferred into a new technology venture fund that QinetiQ launched in partnership with Coller Capital in August. And, of course, a new and "aspirational" brand had to be created.

It emerged from the process as Intrinsiq Materials. It is an intellectual property-generating applications company focusing on providing solutions for companies primarily in clean-tech and health. It is currently working with a broad set of international partners and customers on applications such as photovoltaic solar cells and anti-viral nano-particles that kill viruses such as SARS and avian flu on contact.

Now Intrinsiq has purchased the assets of pSiNutria, a wholly owned subsidiary of pSivida, a global bio-nanotech company based in Perth, Australia. It should be noted here that the largest shareholder in pSivida was none other than.... QinetiQ. The acquisition gives Intrinsiq Materials access to nanoporous silicon technology that addresses the growing need for functional food packaging and improved nutritional delivery from performance foods.

Intrinsiq has purchased and licensed intellectual property involving applications for biosilicon, as well as laboratories, equipment and team of scientists from pSivida Limited, a global drug delivery company. Intrinsiq will make a series of payments totalling US$1.23m in the first year, plus additional royalty payments over the next six years if the license is still in effect.

"The asset purchase of pSiNutria Limited is a key part of our strategy to be recognised as an innovator in nanoscale solutions for our customers," commented Joe Raguso, Intrinsiq's CEO. "The deal includes critical intellectual property and an exceptional team led by Professor Leigh Canham – a leader in the field of porous silicon. It provides critical synergy with our existing markets where we produce bespoke nanomaterials for high value applications via a patented plasma platform technology."