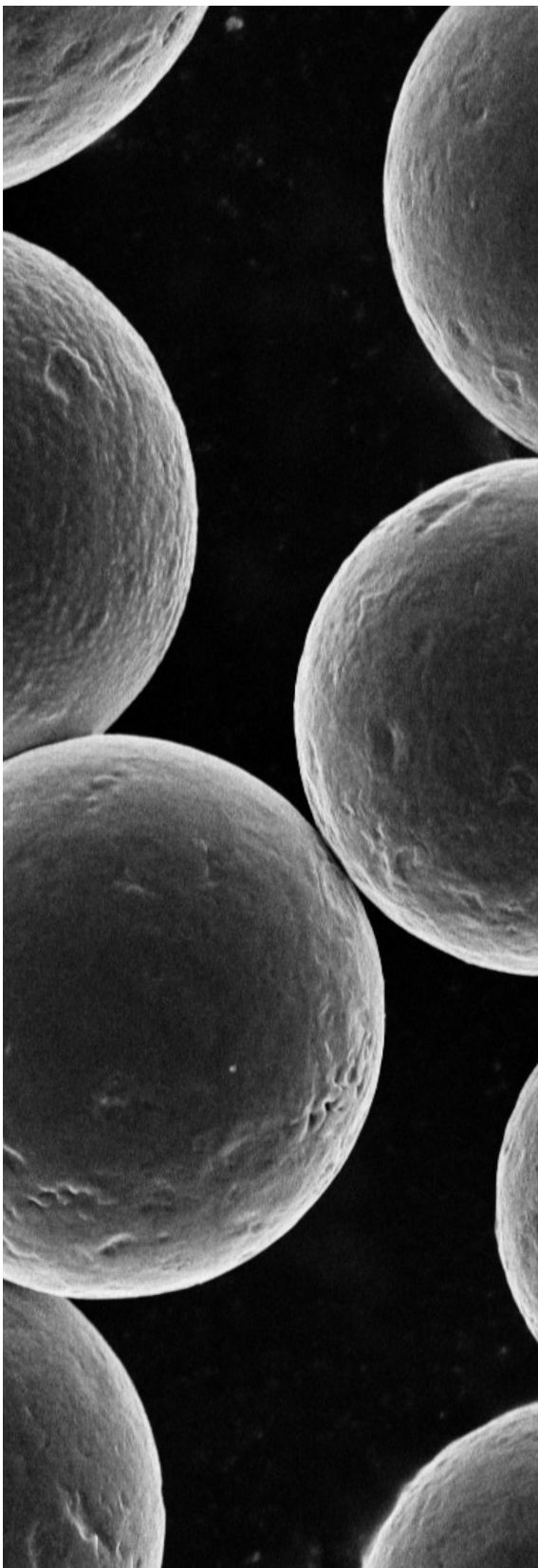
Advancing Powder Technology

CNPC POWDER, reveals new tech launched.

Letter from CEO

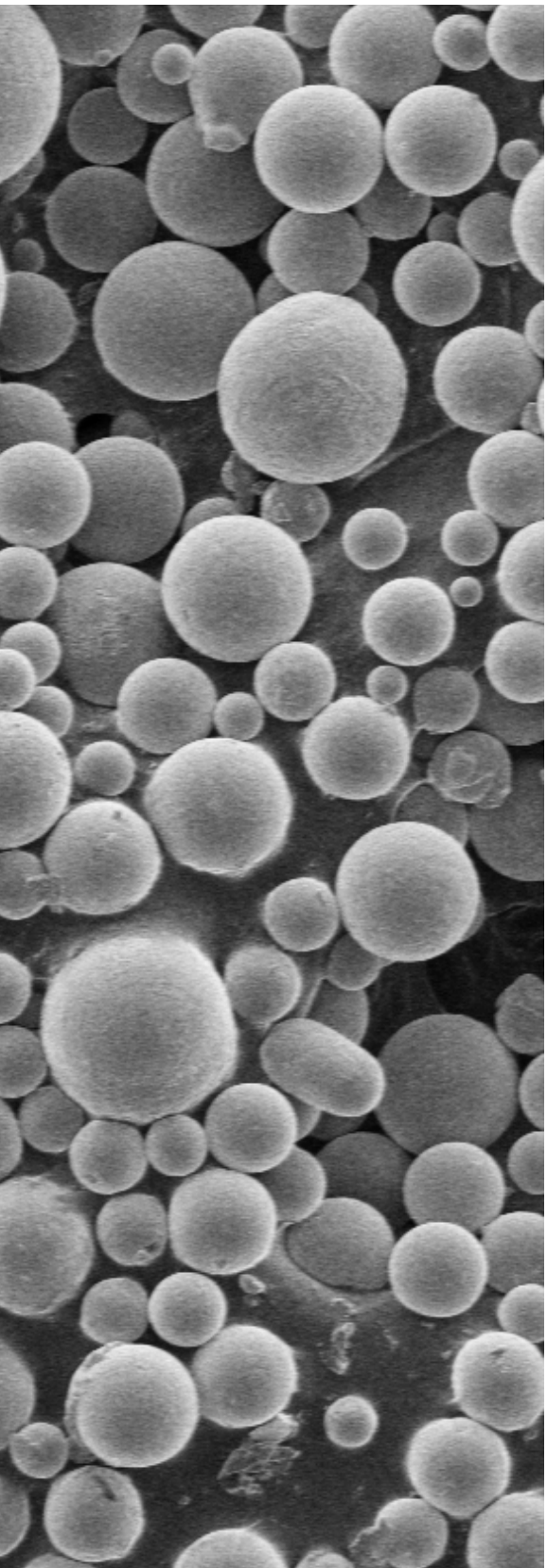
Paul Shen Ph.D.



As CEO of **CNPC POWDER**, it has always been my principal directive to push the envelope in metal powder production. Since our establishment, I have been aiming to promote the industrialization of metal powder technologies and Additive Manufacturing, by actively developing and improving technology while minimizing cost and reducing our footprint on the environment. I believe that as an industry we have come so far, but there is still so much more to do. Over the past few years **CNPC POWDER'**s contributions have been, the development of even higher purity powders for variety of industries, development of a proprietary NanoPrint powder for specialty AM processes. Now our next contribution is our AMP Production line for AM powders.

A principal incentive for AMP has been aluminum's growth path. According to Smartech predictions, the consumption of aluminum alloy for all metal powders in Metal 3D printing (by volume) is going to be gradually increasing from 5.1% in 2014 to about 11.7% in 2026, and the 10-year compound growth rate of aluminum alloy in the automobile industry is 51.2%. All of these indicators place aluminum growth front and center, but current prices are going to be much too high. A new process was needed to meet this demand.

This new facility is going to provide clients a greater capacity to develop more in-depth knowledge of the metal powders.



Now, 3D printing of aluminum alloy has genuinely entered commercial availability in the fields of aerospace and automotive, which has been led by larger volume printers. These large volume printers can provide more significant parts, faster production times and larger capacity for users. With this kind of market environment, **CNPC POWDER** has been focusing its substantial resources toward cutting edge R&D directed at the industrial production of novel metal powder materials for several years. the result is an high purity atomizing production line that can meet the need for high end aluminum alloys at ever more competitive prices, which push the envelope of what can be done both in powder production and additive manufacturing.

We always strive to advance our powder options because we seek to leave a lasting impact on our industry to enhance the capabilities of our users. We can only achieve this by setting high standards of quality, traceability, and replicability of each powder lot. We ensure that our team of professionals have the right skills and experience to deliver real value to our clients and, by extension, our industry.

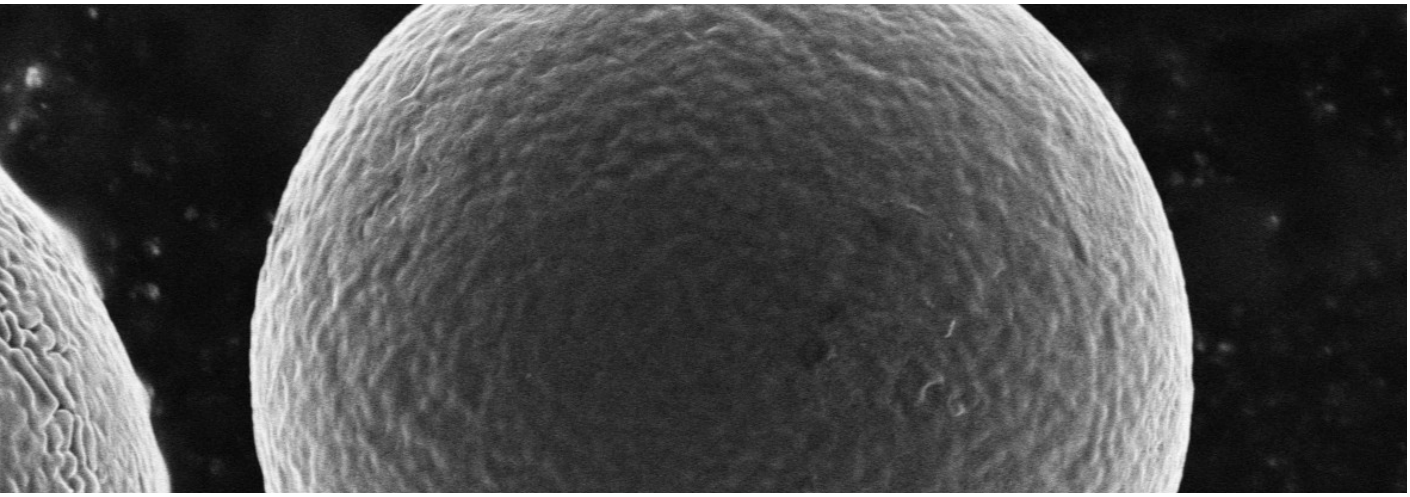
I encourage you to read through this new advancement from **CNPC POWDER** and, more importantly, to travel with us on our journey into the future of AM.

Kind Regards,

Paul Shen Ph.D.

CNPC Powder Technology

Presenting the automated metal production (AMP) line.

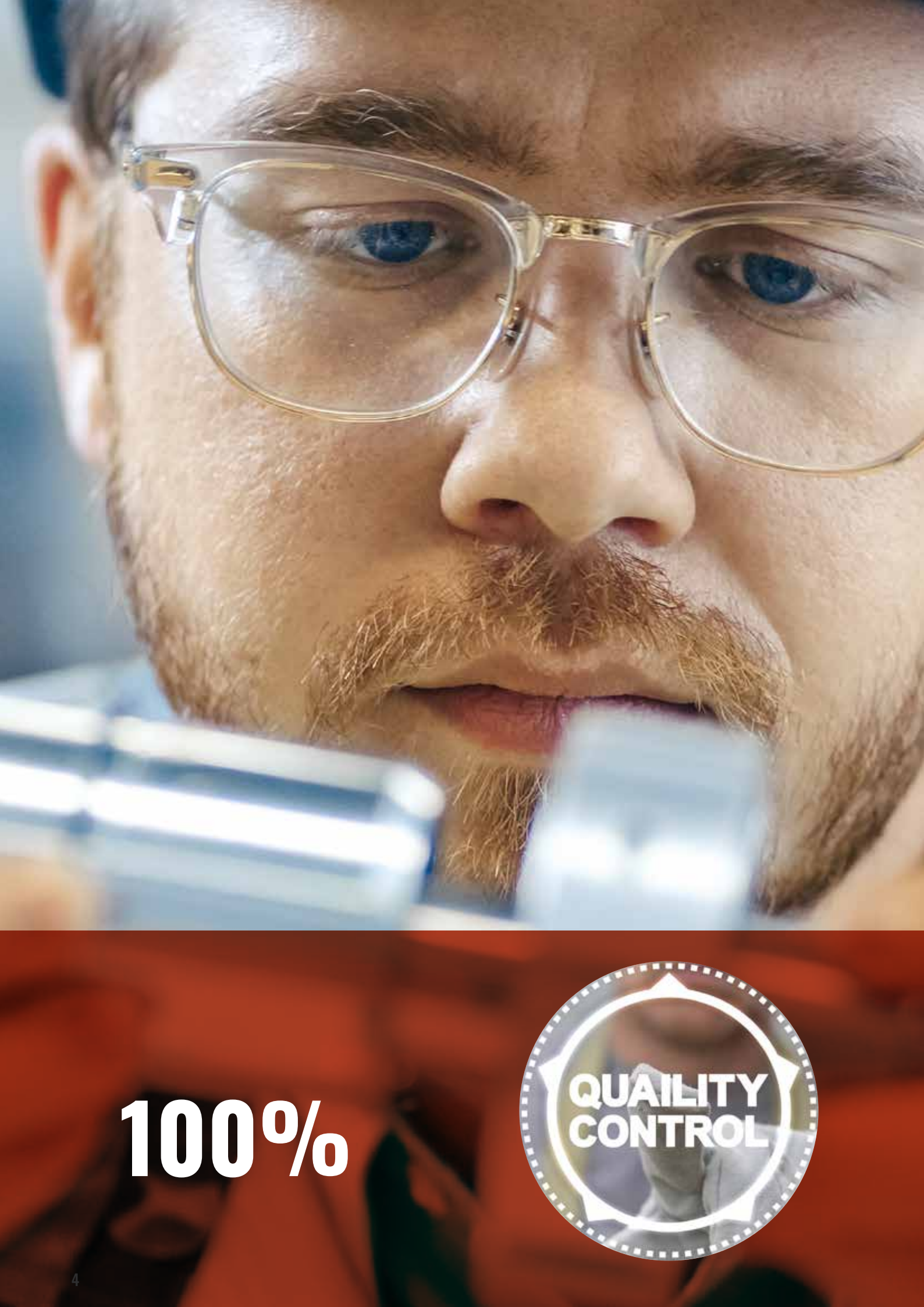


Production Technology	Sphericity	Yield (15-53um or 20-60UM)	Satellites	Impurity	Production Cost
PREP	****	20-30%	Low	no	Medium
VIGA	*	30-40%	High	Yes	Medium
EIGA	**	30-40%	Medium	Yes	High
CNPC AMP Atomizers	****	60-70%	Low	Few	Low

Side By Side Comparison of Available Technology

CNPC POWDER's AMP technology, when compared with the Plasma Rotating Electrode Pulverizing technology (PREP), the aluminum powder produced by AMP atomizers, has a better composition ratio, less gas consumption and lower cost while ensuring high sphericity. These benefits mean that our powder can provide clients with powder that can meet more demanding requirements for AM grade Aluminum alloys and other materials.

- High sphericity and fluidity.
- Low oxygen and low nitrogen levels
- High efficiency for targeted particle sizing
- Higher production output with a much shorter production cycle


100%
QUAILITY
CONTROL

CNPC POWDER

An overview of CNPC POWDER and its experience with metal powders.

CNPC POWDER opened its doors in 1998 as a family business to service the growing domestic powder market. **CNPC POWDER** has grown out of a desire for constant improvement. This has been at the forefront of our specialization in the development and production of high-quality metal powder materials.

Over the years we have made our primary focus the development of materials that exceed client requirements for materials. This focus on exceeding expectation has given us the ability to produce an ever-expanding catalog of powders, and a depth and breadth of knowledge that our clients can leverage to improve their processes and improve their business.

Today **CNPC POWDER**'s determination has allowed for the expansion our markets and has made us a key member of the powder production industry. **CNPC POWDER** has been able to forge new connections with North and South American powder users as well as a growing connection to Europe. As we develop new additive manufacturing powders, our new AM facility and R&D Center have continued to support and innovation for our industry.

CNPC's Powder Facility for AM.

CNPC POWDER's RPM R&D

At the beginning of 2017 **CNPC POWDER** broke ground on our Additive manufacturing facility. This facility is a continuation of our phase three of our growth plan to develop cutting edge metal powders for the additive manufacturing industry. Since then, we have been steadily developing a wide catalog of powders for an ever growing number of applications.

Our AM Facility has been outfitted with six new lines that are focused on ~3500 tons of inert gas spherical atomized metal powders. Focusing on the production of materials for Major OEM machine producers along with aerospace and medical parts producers.

+ 20 YEARS EXPERIENCE

This new facility also houses our new research and development facility.
CNPC POWDER's R&D facility will be focusing on three critical projects.

RESEARCH

The first focus is on new material exploration, which will look at the production of new alloys for AM and MIM applications.

ELEVATE

Second, is the optimization of materials production and cost reduction, which will lead to greater

INNOVATION

Finally, it will serve as a research hub for innovation and advocacy for 3D printing.

AM Powders

CNPC's facility offers cutting edge AM powder for advanced applications.

In the field of automobile manufacturing, the cost of traditional aluminum alloy materials is relatively low. However, in metal 3D printing, both materials and technology are still high-cost propositions. This high upfront investment can be a barrier to entry in applying additive manufacturing technologies to the mass production of aluminum alloy automobile parts. Now, **CNPC POWDER'S** new Automated Metal Production (AMP) technology has been developed to remedy the high cost of 3D printing materials.

Focus on AM

The next generation of AM

CNPC POWDER's AMP technology is a proprietary atomization process that has stripped back current technology and eliminated inefficiencies. This has led to the creation of exceedingly clean, very spherical particles with few satellites. It has also meant that there is a higher output of powder designated for AM, and exceptionally tight particle distribution in a single completed powder lot.

Contributing the AM technology with advance powders.

Putting you in the driver seat!

Aluminum Base Alloy Powder	Composition (%)	O (%)	A.D.g/cm3	Flowability (4mm)
CNPC-AlSi10Mg	Si 9-11,Mg 0.3-0.5, Al Bal.	0.05-0.15	0.8-1.8	≤ 25 s/50g
CNPC-AlSi7Mg	Si 6-8,Mg 0.3-0.5, Al Bal.			≤ 25 s/50g
CNPC-AlSi12	Si 11-13, Al Bal.			≤ 25 s/50g
CNPC-6061	Fe 0.7, Si 0.4-0.8, Mg 0.8-1.2, Zn 0.25, Al Bal.			≤ 25 s/50g
CNPC-2219	Cu 5.8-6.8, Mn 0.2-0.4, Zr 0.1-0.25 Al Bal.		0.9-1.9	≤ 25 s/50g
CNPC-2040	Mg 1-3, Mn 0.3 Al Bal.		1.0-2.0	≤ 25 s/50g

Final Analysis

Our new AMP production line.

As a result of our constant drive to push the envelope on what is possible, our new AMP Powder technology has more considerable advantages for the production of high-quality additive specific materials at a much-reduced production cost. These benefits allow us to become a reliable powder source for large scale industrial powder production.

The need for a truly revolutionary powder production method that lowers the barrier to entry for companies is paramount, and **CNPC POWDER'**s suite of AMP powders for AM are part of that revolutionary effective solution.

Contact us today to see how **CNPC POWDER'**s AMP Aluminum alloys can provide the solution that you have been looking for.

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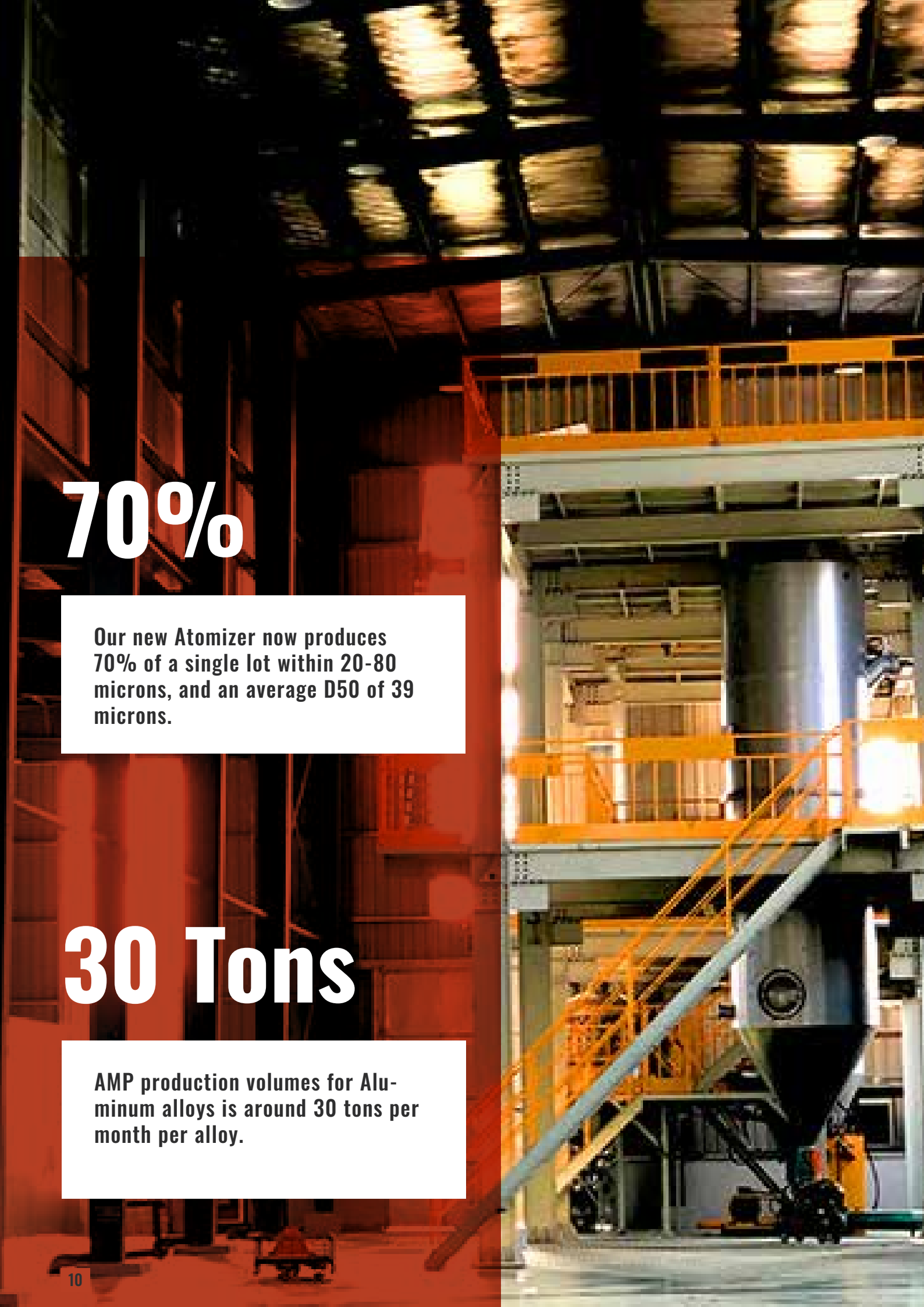

70%

Our new Atomizer now produces 70% of a single lot within 20-80 microns, and an average D50 of 39 microns.

30 Tons

AMP production volumes for Aluminum alloys is around 30 tons per month per alloy.