THE ULTRA NANO-GRAIN COPPER ANODE

A PRODUCT OF

M E T A L M E N
METALMEN VENTURES (SINGAPORE) PTE LTD

W W W . S U N N B A L L . C O M
COMPANY PROFILE

METALMEN VENTURES (SINGAPORE) PTE LTD is Asia’s leading & India’s single biggest supplier of Copper Electroplating Anodes & VALE Nickel plating products. The promoters, established in 1966, were pioneers in introducing high quality Copper & Copper alloy products to the industry. And now with the development of super advantageous Ultra NANO-GRAIN Copper Anodes using the proprietary MPCA technology, we aim to capture the World market & become the single biggest supplier of Copper anodes.

Our foundation pillars are HONESTY, INTEGRITY & BUSINESS ETHICS.

OUR PROCESS

SUNNBALL ULTRA NANO-GRAIN COPPER ANODES are made using the proprietary MPCA technology, which has given the world it’s first ULTRA NANO-GRAIN COPPER ANODE. SUNNBALL anode shows outstanding performance in plating application. It has the perfect surface and the best grain structure with extremely uniform distribution of phosphorus. Comparing normal copper anode, SUNNBALL Ultra NANO-GRAIN copper anode ensures superior product quality and less overall production costs in the consideration of user’s long term benefits.

PRODUCTION PROCESS

LME Grade A Copper Cathode

Special High Grade Phosphorus Master Alloy

CHEMICAL COMPOSITION

- PHOSPHORUS COPPER ANODES

<table>
<thead>
<tr>
<th>Cu%</th>
<th>Phosphorus%</th>
<th>Fe%</th>
<th>Pb%</th>
<th>Ni%</th>
<th>Zn%</th>
<th>Sn%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥99.93</td>
<td>0.025~0.055</td>
<td>≤0.003</td>
<td>≤0.003</td>
<td>≤0.003</td>
<td>≤0.003</td>
<td>≤0.003</td>
</tr>
</tbody>
</table>

- OXYGEN FREE COPPER ANODES

<table>
<thead>
<tr>
<th>Cu+Ag%</th>
<th>Fe%</th>
<th>Pb%</th>
<th>Ni%</th>
<th>Zn%</th>
<th>Sb%</th>
<th>Sn%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥99.99</td>
<td>≤0.001</td>
<td>≤0.003</td>
<td>≤0.003</td>
<td>≤0.003</td>
<td>≤0.003</td>
<td>≤0.003</td>
</tr>
</tbody>
</table>

OUR PRODUCT SPECIFICATIONS

<table>
<thead>
<tr>
<th>Balls</th>
<th>25mm</th>
<th>28mm</th>
<th>33mm</th>
<th>40mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45mm</td>
<td>50mm</td>
<td>51mm</td>
<td>55mm</td>
</tr>
<tr>
<td>Nuggets</td>
<td>8x15mm</td>
<td>12x20mm</td>
<td>16x30mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17x30mm</td>
<td>20x30mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ovals</td>
<td>Any Size</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

 PACKAGING

10/20/25 kg Carton Box on Pallets
50 kg Plastic Drums
COMPARISON OF SURFACE

- COPPER ANODES -

Uneven Surface, with a little Copper powder on surface.

- NANO-GRANULAR COPPER ANODE -

Smooth and even surface, No Copper Powder.

(Figure - 1)

COMPARISON OF STRUCTURE

<table>
<thead>
<tr>
<th>COPPER ANODE 1</th>
<th>COPPER ANODE 2</th>
<th>COPPER ANODE From USA</th>
<th>NANO-GRANULAR COPPER ANODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Casting state (made in Taiwan, China Mainland)</td>
<td>Structure Casting state (made in Taiwan, China Mainland)</td>
<td>Structure Casting state (made in Taiwan, China Mainland)</td>
<td>Structure Casting state (made in Taiwan, China Mainland)</td>
</tr>
<tr>
<td>• Big Grain shows after using Na2S208</td>
<td>• No grain shows after using Na2S208.</td>
<td>• No grain shows after using Na2S208.</td>
<td>• No grain shows after using Na2S208.</td>
</tr>
<tr>
<td>• Clearly find Grain after Magnified one hundred times. Phosphorus enrichment in NANOstructure. Grain boundary exist.</td>
<td>• Didn’t find grain after Magnified 400 times. “Having serious problem about dephosphorization on surface”</td>
<td>• Didn’t find grain after Magnified 400 times. “Having serious problem about dephosphorization on surface”.</td>
<td>Crystallite state: Few grain shows after using Na2S208, finding grain after Magnified 400 times. Even distribution of Phosphorus. Layer is very stable and not easy to fall off.</td>
</tr>
<tr>
<td>• Uneven thickness of layer.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Figure - 2)

PRACTICAL APPLICATIONS - LABORATORY EXPERIMENTS

<table>
<thead>
<tr>
<th>COPPER ANODE</th>
<th>COPPER ANODE FROM USA</th>
<th>NANO-GRANULAR COPPER ANODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Min.</td>
<td>120 Min.</td>
<td>30 Min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Layer appeared fast. At 20 minutes, the layer covered the ball and evenly. The layer is unstable.</td>
<td>• Layer appeared slowly. At 30 minutes, the layer still can not cover the whole ball. The layer still not cover the ball at 120 minutes.</td>
<td>• Layer appeared fast. The Layer basically covered the ball at 30 to 40 minutes. The layer appeared smoothly, and thin, but stable.</td>
</tr>
</tbody>
</table>
NORMAL ANODE VS SUNNBALL ANODE

PRACTICAL APPLICATIONS - ACTUAL EFFECT ON PRODUCTION SITE

- **COPPER ANODES**
- **NANO-GRAIN COPPER ANODE**

- After long time using, the surface of Nano-Grain Copper Anode is more smooth than normal copper anode, and do not have big cracks.
- It shows that Nano-Grain Copper Anode melts evenly, which decreases the accidental factor of electroplating.

(Figure -4)

COMPARISON OF MEMBRANE QUALITY ON PRODUCTION LINE

- **COPPER ANODES**
- **NANO-GRAIN COPPER ANODE**

- The flyer made by Nano-Grain Copper Anode is more stable than normal copper anode, as shown in the photos.

(Figure -5)

PRACTICAL APPLICATIONS - ACTUAL EFFECT ON PRODUCTION SITE

- **COPPER ANODES**
- **NANO-GRAIN COPPER ANODE**

The thickness is thick and the and the speed of losing bath is slow.
The thickness is thin and the and the speed of losing bath is fast.

(Figure -6)
COPPER ANODES - THE SUNNBALL ADVANTAGE

SUNNBALL ULTRA NANO-GRAIN COPPER ANODE shows outstanding performance in the highly demanding plating applications. It has the perfect surface and the best grain structure with extremely uniform distribution of phosphorus. The copper crystal structure of SUNNBALL Anodes consists of ULTRA NANO-GRAINS. As a result of MPCA technology, both grain size and shape are the same in the entire batch of anodes. Ultra Nano-grains copper dissolve evenly and guarantee a stable anode film on the ball surface. Super fine grain size also ensures better anode film adhesion (see Figure 5 on page 4) and thus less anode sludge creation and less consumption of organic plating additives.

THE ULTRA NANO-GRAIN TECHNICAL ADVANTAGES

Low Phosphorus & Even Distribution
(* see Figure 2 on page 3 & Figure 5 on page 4)
In terms of the Phosphorus content, the Sunnball Ultra Nano-Grain Anodes has lower than the normal one. That is because the phosphorus distribute evenly in grain structure and can release the copper ion stably, so the lower phosphorus is required. What is more, low phosphorus also meet the environment requirements. It is also one characteristics of Nano-Grain Copper Anodes.

More Copper Per Ball
SUNNBALL COPPER ANODES weigh upto 7.50-20% more than the same diameters balls of other brands. MPCA technology compresses the anode & reforms it’s entire grain structure and is very good in prevention of porous erosion of the ball and to avoid nodular plating caused by undissolved copper dust in the plating tank.

Low Optimum Consumption Of Copper Anodes
According to laboratory experiments, using NANO-GRAIN copper Anode can save 3-5% Copper anode for every ton. The Copper content in the plating is stable – meaning most optimum consumption of copper.

Low Iron Content
Normal standard for Fe (Iron) is 30ppm and most mills supply iron content between 10-30ppm. Our Internal standard is much tighter and we try to keep it at less than 10ppm.

Low Other Impurities
Tin, lead and silver form sludge that floats in the bath causing inclusions and a rough finish to the coating. Antimony and bismuth will reduce the mechanical stress capability. Inhomogeneous casting structures with oxides and pores can decrease formability and therefore the quality of the end product.

Low Sludge Generation
(* see Figure 6 on page 4)
Impurities like iron, nickel, zinc and arsenic tend to dissolve in the plating bath and get enriched as time goes by. If the impurity level is high enough, elements start to interfere with the plating process by precipitating on the coating. This leads to lower electrical conductivity, stresses and changing mechanical properties of the coating. Impurities can reduce the physical properties such as ductility.

Time Savings – Higher Productivity
The build-up of the adherent anode’s film is rapid and strong that allows a problem-free start-up of the new bath with Phosphorised Copper Anodes (* see Figure 3 on page 3)
Due to low sludge formation you can double the time gap between changing container & cleaning the tanks / titanium baskets (* see photo 6 on page 4)

Extra Annual Discounts & Rebates For Signing Annual Contracts
Most buyers are loyal to us & buy regularly from us – we value their loyalty & trust and in return offer them Annual discounts & rebates based on their volumes – IF THEY SIGN ANNUAL CONTRACTS WITH US. This discount is over & above our normally highly competitive price.

Best Hedging Partners
We offer hedging & forward booking contracts up to 6 months ahead
OUR PRODUCTS

- COPPER BALLS
- COPPER NUGGETS
- VALE NICKLE PELLETS - S/R/P
- VALE NICKLE CHIPS

WE ARE ALSO DISTRIBUTORS FOR
VALE SWITZERLAND A.G. NICKEL ELECTROPLATING PRODUCTS

PRODUCT APPLICATIONS

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