

MITSUBISHI

MITSUBISHI MATERIALS CORPORATION



.IOA-QM8110



.IOA-FM0818

Technical Document

Copper Anode Balls



55mm diameter Copper Anode

Characteristics

Fine and homogenous structure leads to uniform plating
 Free from oil contamination and will not gum up plating solution

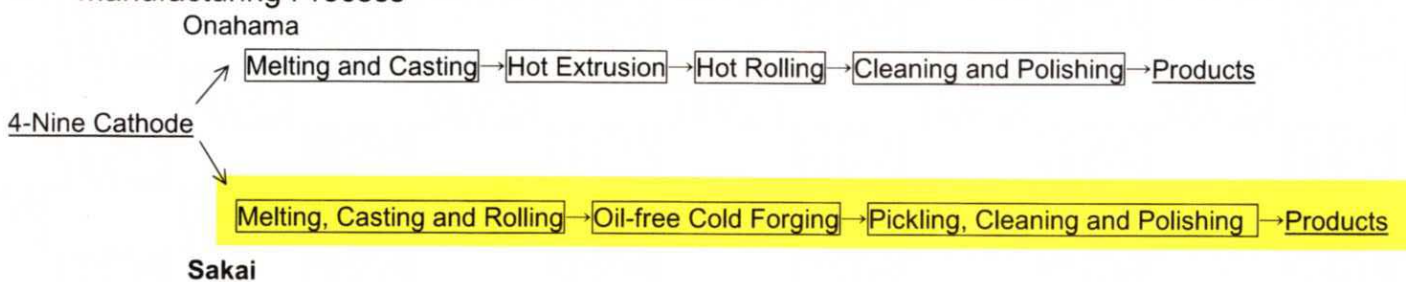
Product

- Size : 27, 40, 45, 55 mm ϕ
- Packing : 20 kg Cardboard Box
- Pallet : 800 kg, 1,000 kg, 1,200 kg, 2,000 kg

Product Specifications

Type	Code	Color	Cu (%)	O (ppm)	P (ppm)
Phosphorous	D C	Red Banding	≥ 99.95	≤ 20	350 ~ 450
"	D D	White Banding	≥ 99.93	≤ 20	450 ~ 600
Oxygen-Free	F F	Blue Banding	≥ 99.99	≤ 10	—
Low Oxygen	F B	Gray Banding	≥ 99.99	≤ 20	—

Manufacturing Process



Copper anodes made at the Sakai Plant have a low level of oil contamination, near or equal to traditional hot rolled products. This is achieved through our oil-free cold forging and special cleaning processes.

Quality

○ Surface Oil (Typical Data 55mm φ)

mg/pcs

Type	A Company	B Company	Onahama	Sakai
Amount	0.5 0	0.3 0	< 0.0 3	< 0.0 3

○ Surface Copper Dust (Typical Data 55mm φ)

mg/pcs

Type	A Company	B Company	Onahama	Sakai
Amount	6	2 4	1 ~ 6	1 ~ 2

Sakai and Onahama products are identical. Comparing MMC products to others we find that MMC's has nearly nonexistent levels of oil contamination and low levels of copper dust.

○ Composition (Typical Data 55mm φ)

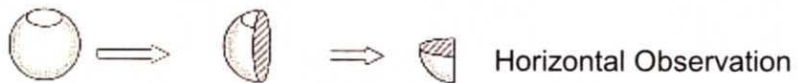
ppm

	P	O	As	Sb	Te	Bi	Cd	Fe	Pb	Mn	Ni	Se	Ag	S	Sn	Zn
A Company	411	32	< 1	< 1	< 1	< 1	< 1	40	1	< 1	2	< 1	12	15	< 1	1
Onahama	400	6	< 1	< 1	< 1	< 1	< 1	2	1	< 1	1	< 1	10	5	< 1	< 1
Sakai	410	4	< 1	< 1	< 1	< 1	< 1	1	1	< 1	1	< 1	8	3	< 1	< 1
ASTM C10100	—	—	≤5	≤4	≤2	≤1	≤1	≤10	≤5	≤0.5	≤10	≤3	≤25	≤15	≤2	≤1

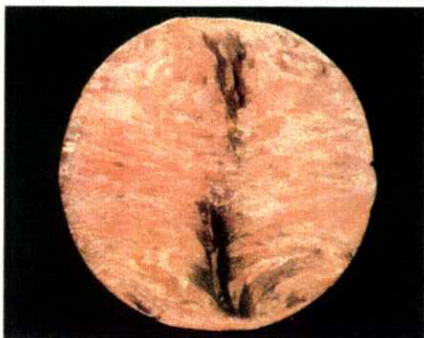
Copper anodes made at Sakai are very low in impurity levels; much lower than other commonly available products. As a result copper content in the plating is stable.

Grain Structure

Vertical Observation



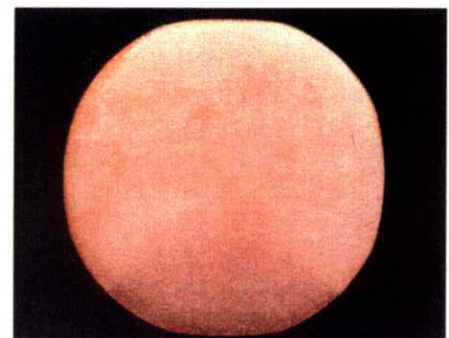
○ Macrostructure vertical observation



A Company



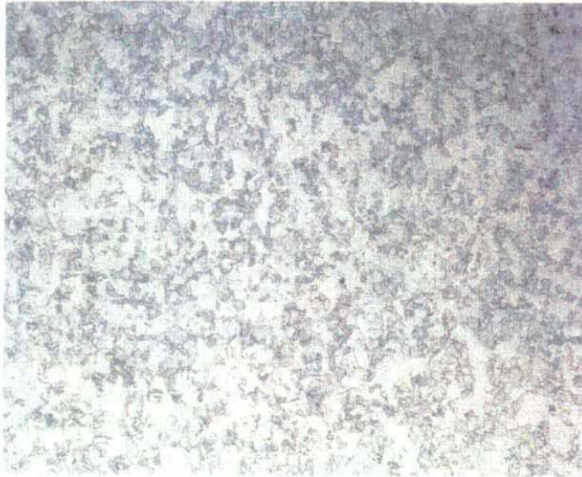
Onahama



Sakai

MMC copper anodes have a finer grain structure than other commonly available products. While Onahama anodes have an excellent grain structure, anodes from Sakai are even finer.

○ Microstructure (Sakai Products)



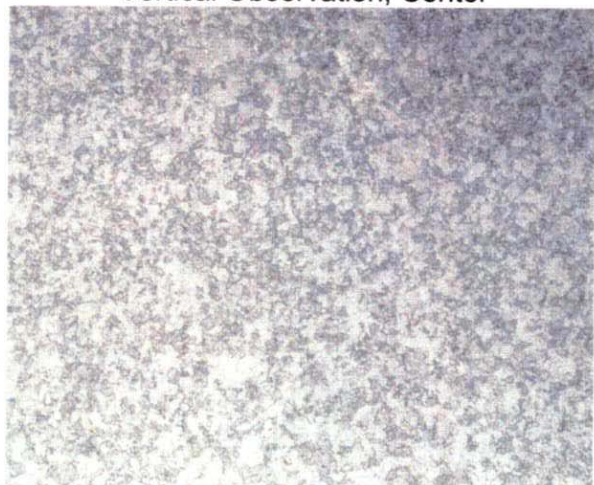
Vertical Observation, Near Surface



Vertical Observation, Center



Horizontal Observation, Near Surface



Horizontal Observation, Center

all photos are magnified 50 times

The microstructure is fine and homogeneous from every observation.

General cold forging after casting will bring rough grain structure. The ball having rough grain structure does not result in stable plating. On the other hand, Sakai's process has hot working process between casting and forging. So the grain structure is very fine and we can supply copper anodes with good properties for plating.

