Technical data

S-Pak Pb Free Solder Balls

World No.1 Solder ball Hidden Champion

1. Balling Process

Balling process in Inert Gas process

→ Melted SAC alloy is dropping, cooling and become solidification in Inert Gas(N2, He, Ar) atmosphere.

→ There are no oxidation content during solidification and strong for oxidization

Inert Gas Process

- eliminate Oxide in a vacuum

- Solidification in a N2 Gas

Oxidization Chemical Reaction

$Sn + O_2 \rightarrow SnO_2$

Reactive material

$Sn \rightarrow Sn^{4+} + 4e^-$

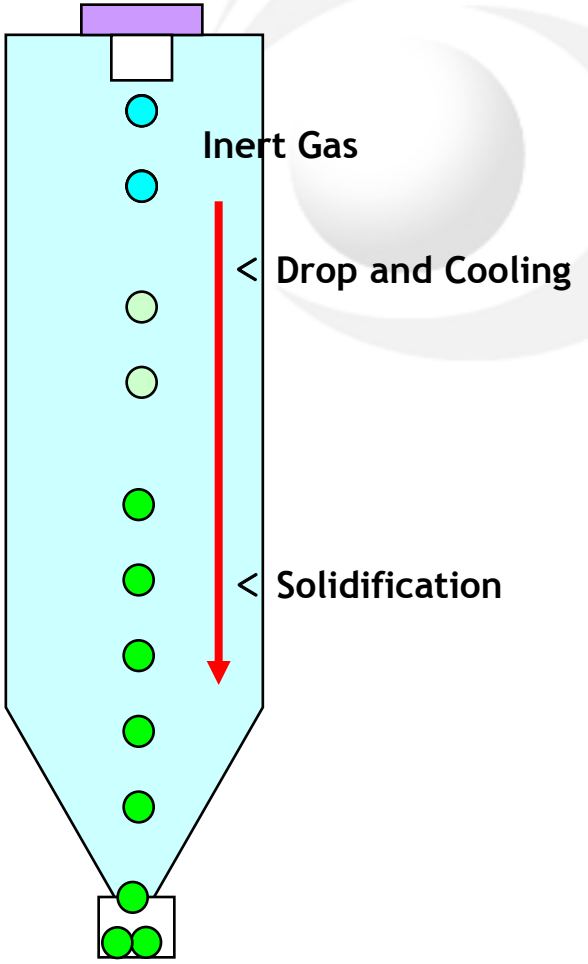
$2Sn + O_2 \rightarrow 2SnO$

$2SnO + O_2 \rightarrow 2SnO_2$

$Sn \rightarrow Sn^{2+} + 2e^-$

$Sn^{2+} \rightarrow Sn^{4+} + 2e^-$

※ Reactive material : O_2, H_2O, acid etc.



2. Surface oxidization layer thickness

Facility: Auger depth (AES/AM PHI 660)

Etching condition: Reference SiO2, 21Å/min.

Results

Division	Oxidization Layer Thickness	
	Present DATA	Internal Limited spec.
SAC105/0.250MM	≤ 80Å	≤ 100Å
SAC1205/0.250MM	≤ 60Å	≤ 100Å
SAC305/0.250MM	≤ 80Å	≤ 100Å
SAC405/0.250MM	≤ 80Å	≤ 100Å
Mena value	≤ 75Å	≤ 100Å

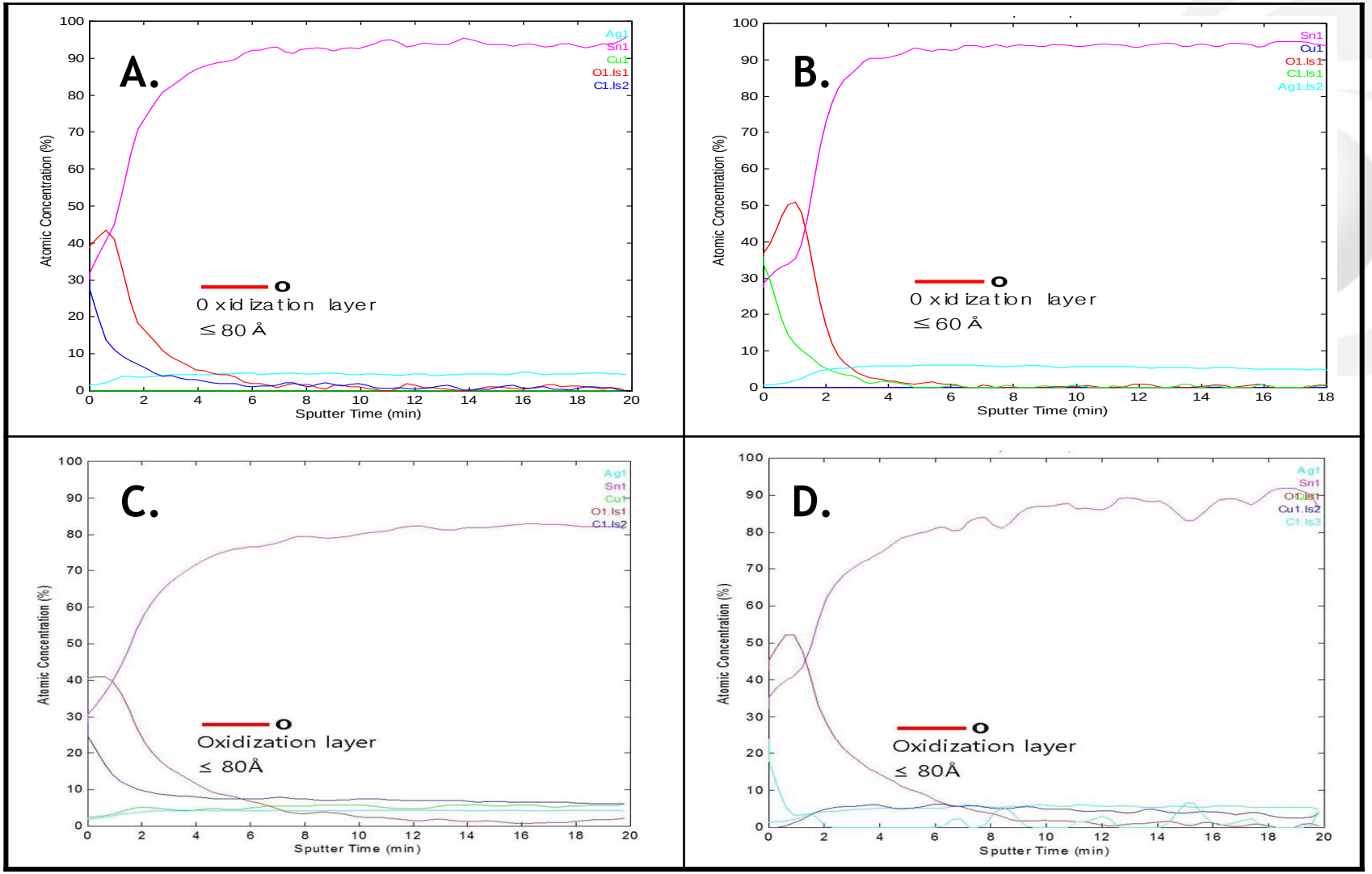
- We control that Thickness of surface oxidization layer on solder ball below 100Å

Its almost as same level of natural oxidization layer.

2. Surface oxidization layer thickness

A. : SAC 105 C. : SAC 305

B. : SAC 1205 D. : SAC 405

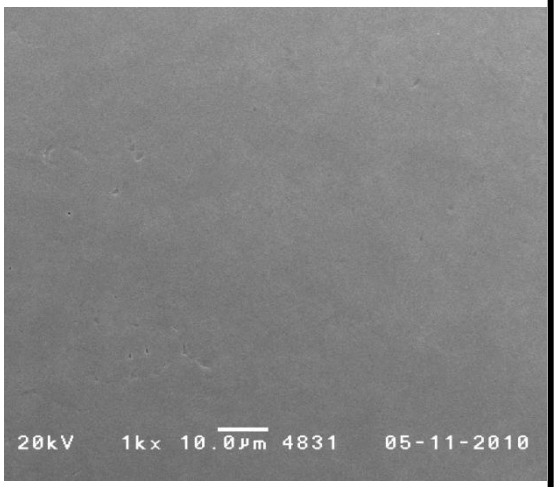
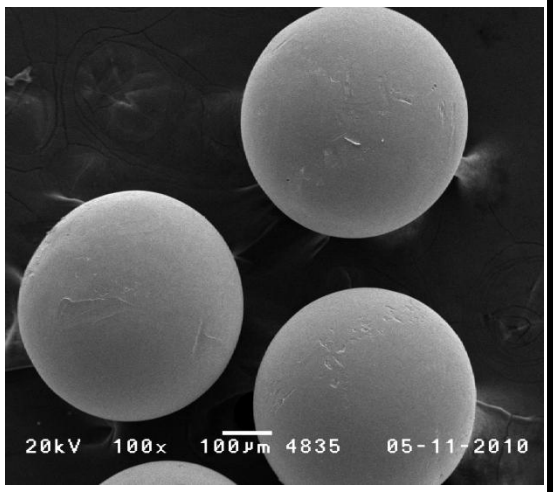
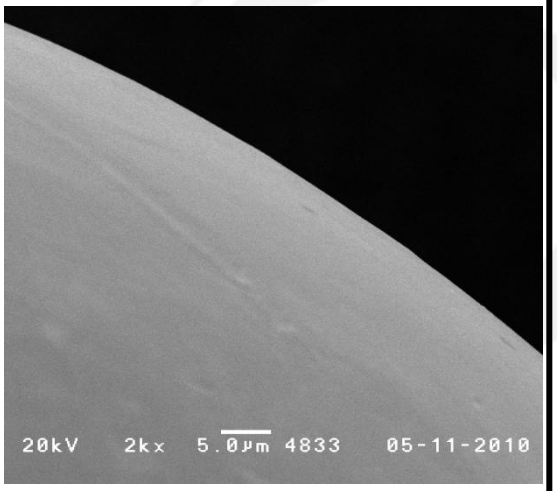
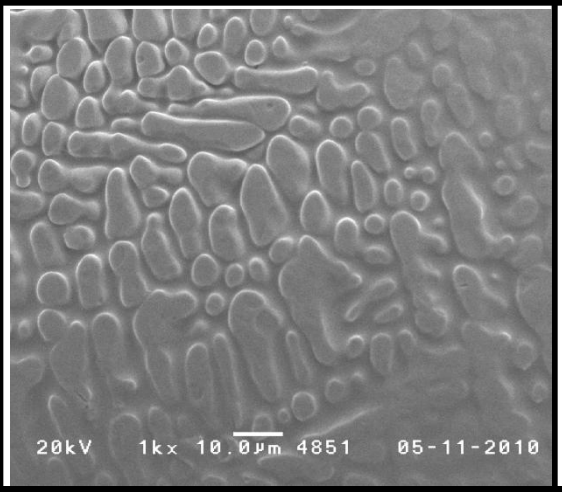
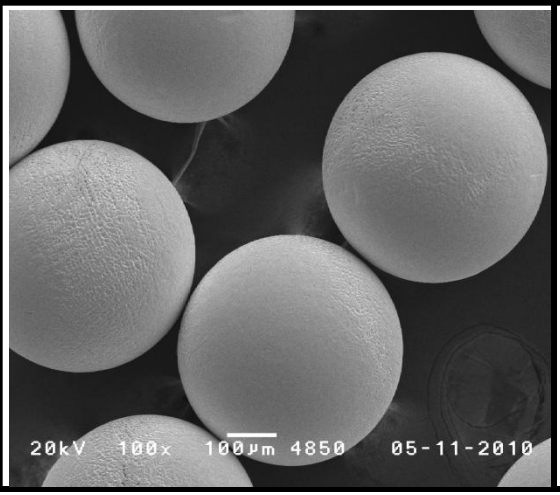
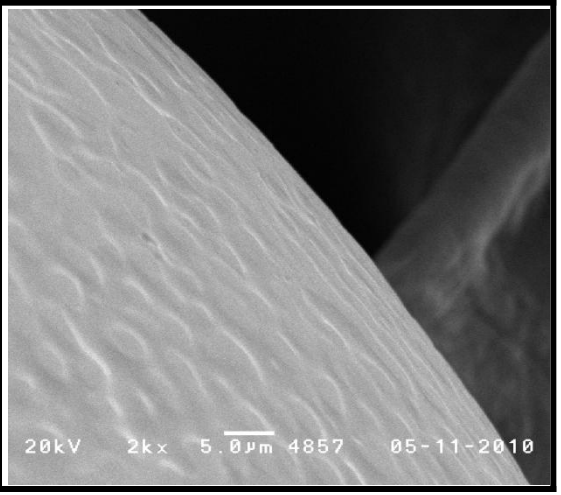


3. Ball surface condition

SDS

Equipment : SEM SM300
Maker : TOPCON

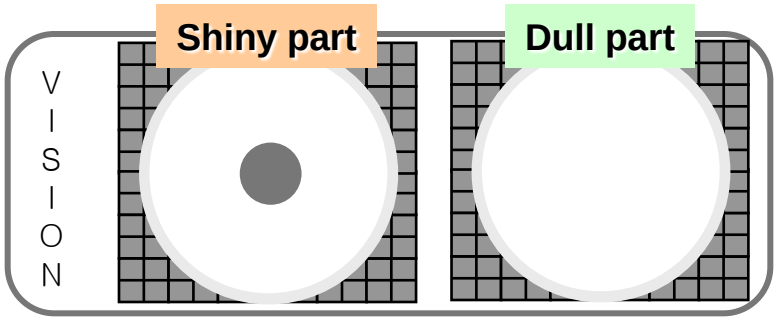
Appearance of Ball Surface : 0.250mm

Div.	Center of Ball X 1000	X 100	Side of Ball X 2000
Shiny Part			
Dull Part			

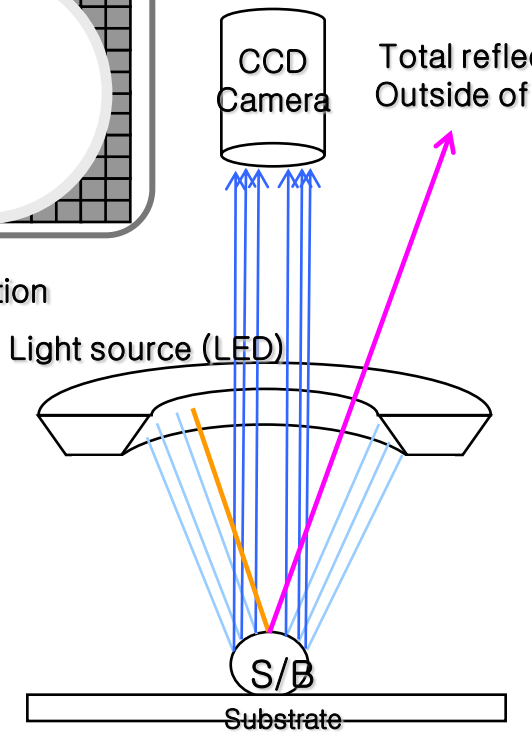
Experimental apparatus or equipment

SDS

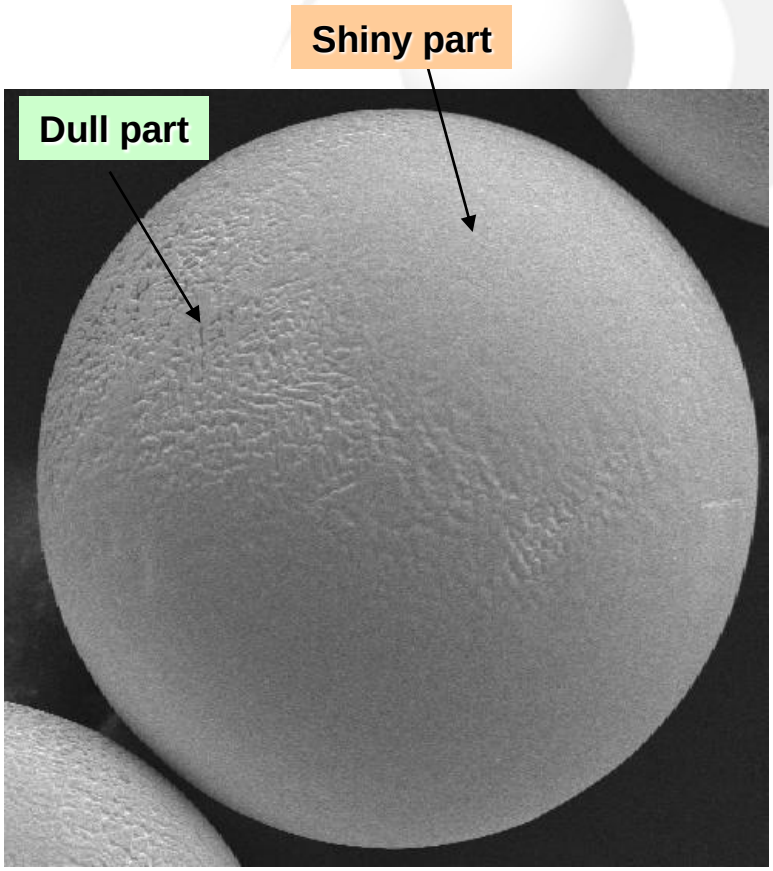
-Pb free ball have two melting temp. such as Solidus temp. and liquids Temp.
it's difference about 2 degree make ball surface two part.
-High dendrite surface (dull part) and low dendrite surface (shiny part), it results different LED light reflection.
In case of shiny part have total reflection and about 10% of reflection light near area of ball center could not go to optical head area of CCD camera. However, Dull part have almost diffused reflection.



Shape of CCD Camera illumination

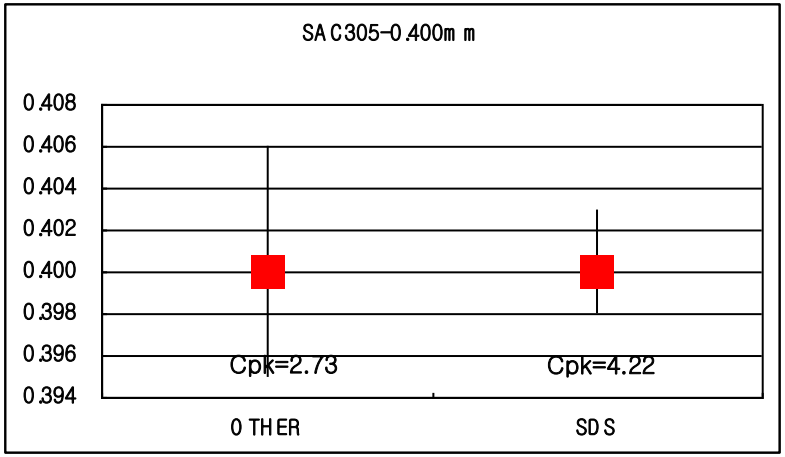


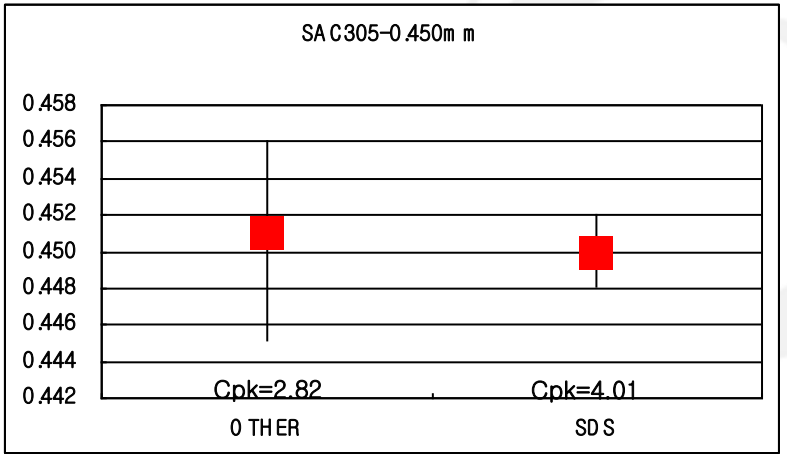
Vision apparatus design

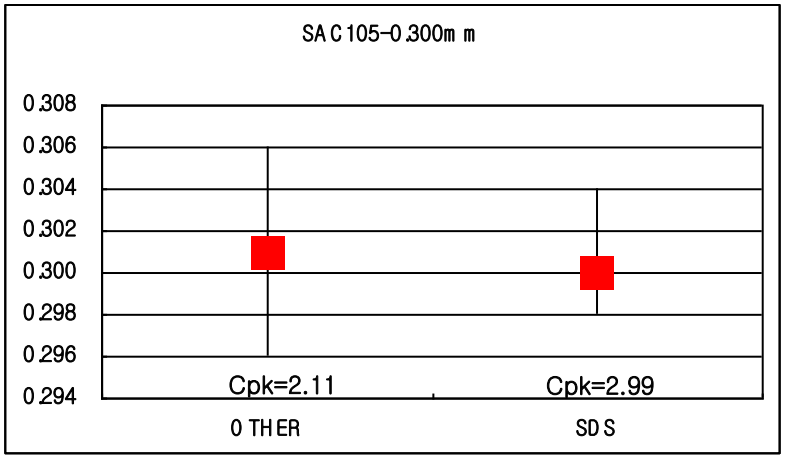


4. Ball diameter and sphericity 1.

1. Ball diameter : 0.300, 0.400, 0.450mm



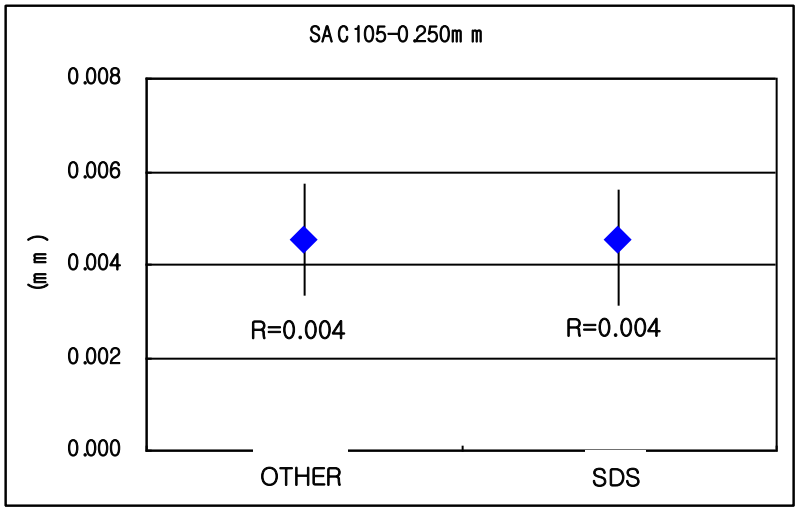


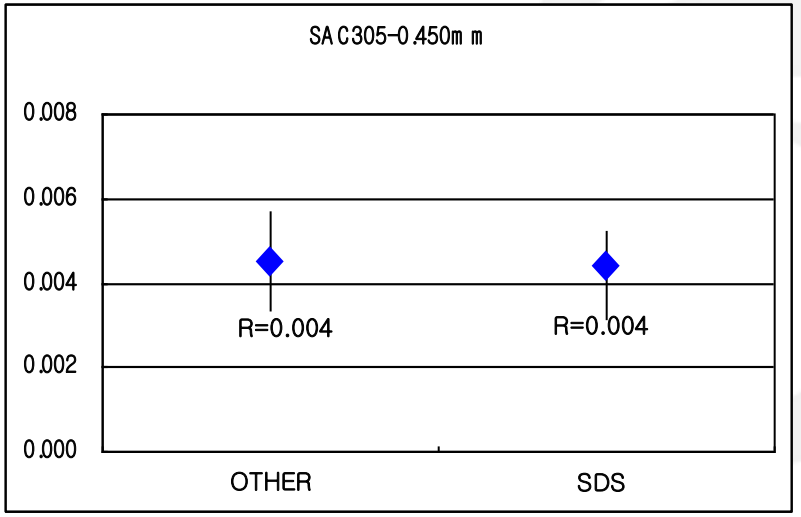


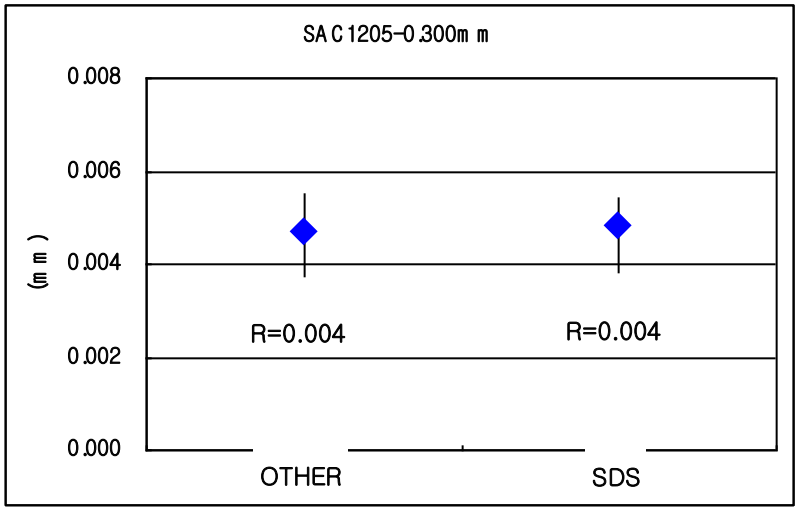
- 3D analysis M/C : Mitutoyo quick scope QS-L1020Z/AF
- Tolerance: +/- 0.0015mm
- n=310 balls measurement

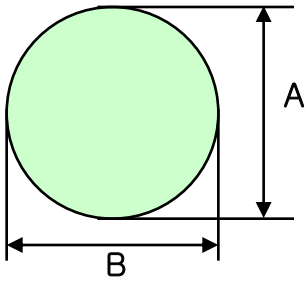
5. Ball diameter and sphericity 2.

2. Ball sphericity : 0.250, 0.300, 0.450mm









Sphericity (Circular value)

=|A−B / {(A+B)÷2}

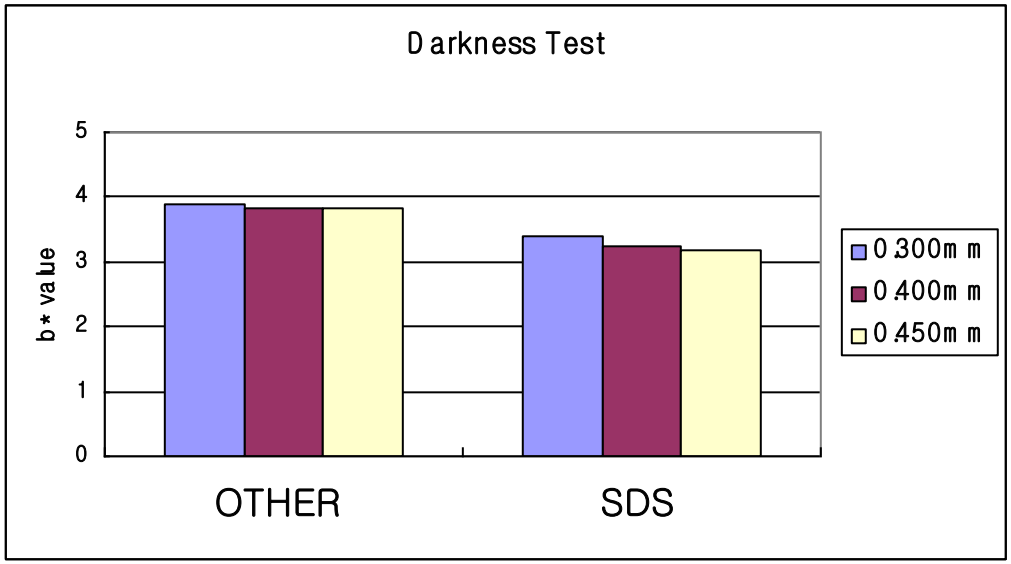
Ex)|0.459−0.457|/{(0.459+0.457)÷2}

= 0.0044

6. Darkness Test

▶ Test condition and sample

Sample	Equipment	Method	Sample weight	Measurement	Etc.
SAC 305 0.300mm 0.400mm 0.450mm	CM-3500d (spectrophotometer)	1. Sample loading in container. 2. Check right could not go through the container with sample. 3. Measure Spectrophotometer	40g	b*(D65) Value	The higher value is closer to yellowish



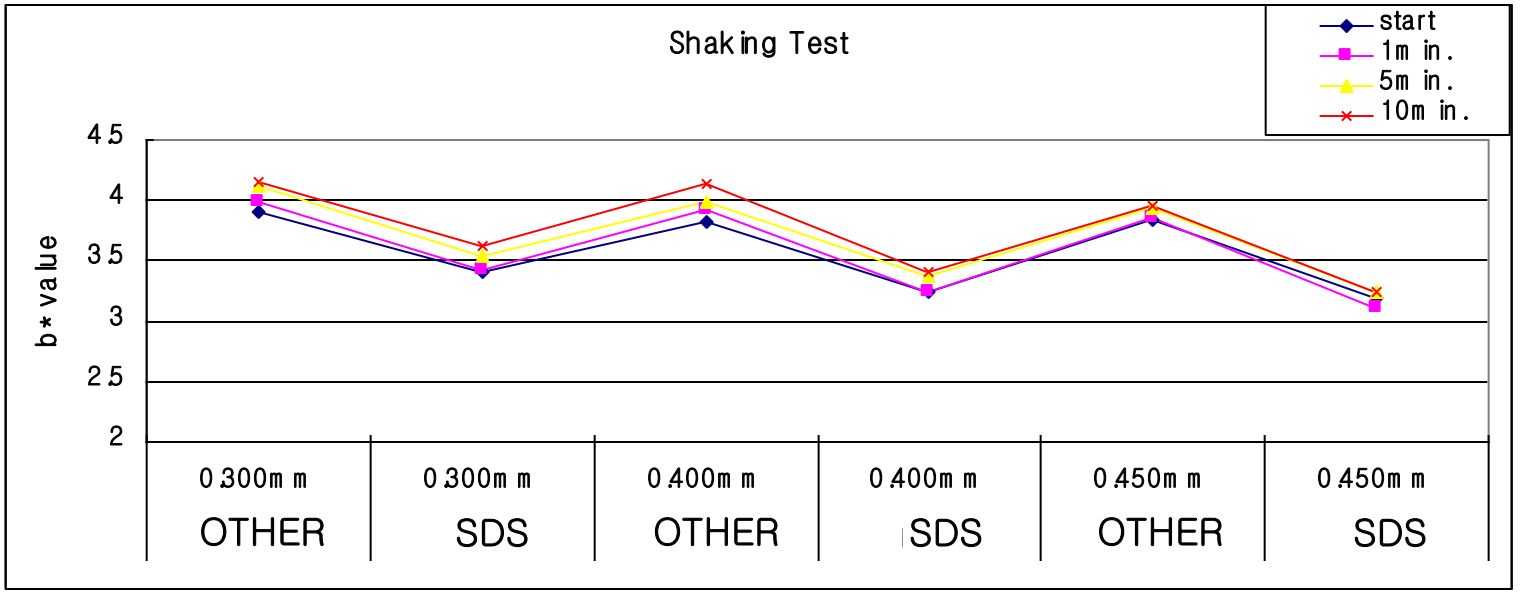
Result.

SDS's solder balls are brighter than other balls just after balling process.
It means that
SDS solder balls good for anti-oxidization Compare to other balls

7. Shaking Test Results

▶ Test condition and sample

Sample	Equipment	Shaking condition	Sample weight	Measurement	Room condition
SAC 305 0.300mm 0.400mm 0.450mm	CM-3500d (spectrophoto meter)	RPM: 260 Bottle size: 70mm Shaking distance: 70mm	40g	Vib. after 1, 5, 10 min. b*(D65) Value	Humidity controlled clean room (class 10,000)



Result.

SDS's solder balls are stronger than other balls in part of shaking condition.