LBMA
Ag Certified Reference Materials(CRM) Project Update

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Our Profile

- Tanaka Kikinzoku Kogyo K.K.(Tanaka K.K.) is a member of Tanaka Kikinzoku Group and a Japanese leading precious metals trader, refiner and manufacturer established in 1885.
- Tanaka K.K. is engaged with not only gold and silver but platinum group metals in the industrial and investment market. Our bars and its kind are registered as “Good Delivery” in the market place worldwide such as LBMA, LPPM, COMEX, NYMEX and DMCC. Tanaka K.K. is Good Delivery Referee for LBMA and LPPM.
- The Group is also active environmentally, and is one of the world largest recyclers of platinum group metals.
- Tanaka K.K. had produced first Au CRMs for LBMA and first Pt and Pd CRMs for LPPM

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Outline

1. History of LBMA CRMs
2. Production background of New AgRMs
3. Specification of AgRMs
4. Plan & Achievement
5. Manufacturing of Master alloys
6. Melting
7. Rolling & Cutting
8. Homogeneity Testing
9. Communication with LBMA
10. Future plan
11. Conclusion

LBMA
GOOD DELIVERY REFEREE

1. History of LBMA CRMs

2007 Call for tenders for Gold and Silver

2008 Successful tenders decided

- AuRM1,2 : Tanaka
- AgRM1,2 : Krastsvetmet

Mar 2008 Production started(AuRMs by TKK)

Feb 2009 Sale of AuRMs by LBMA

Jun 2010 Sale of AgRMs by LBMA

Apr 2012 Call for tenders for AuRM3

Jun 2012 Successful tender decided

- AuRM3 : Krastsvetmet

Jun 2014 Sale of AuRM3

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2. Production background of New AgRMs

Feb 2016 Sold out : AuRM1,2 and AgRM1,2

Mar 2016 Call for tenders for Gold and silver New CRMs

Jun 2016 Successful tenders decided

- AgRM4,5 : TKK
- AuRM4,5 : Krastsvetmet

Oct 2017 Contract for AgRMs : TKK

Nov 2017 Production started(AgRM by TKK)

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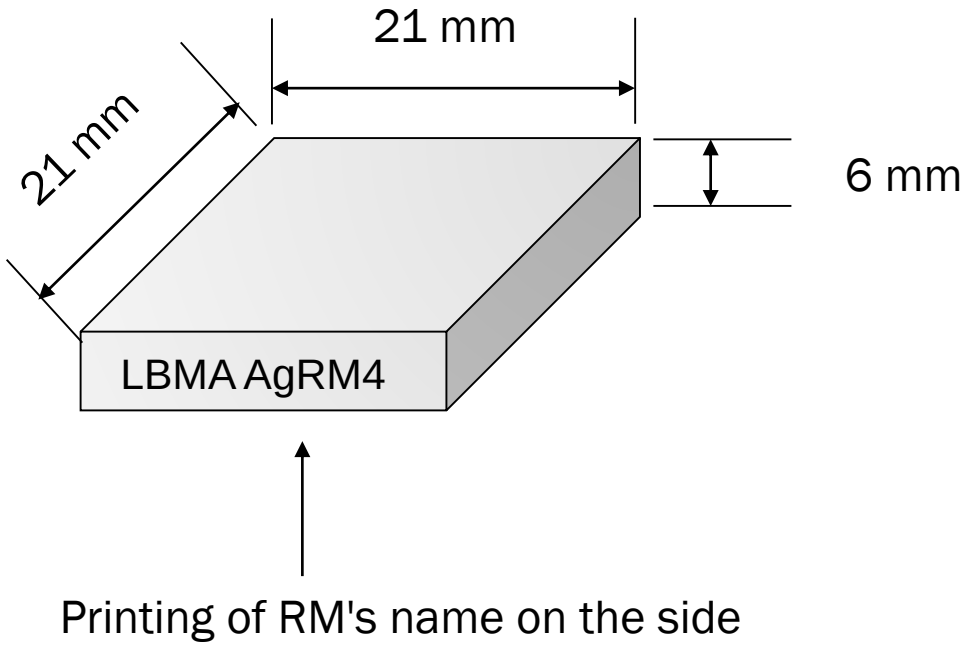
3. Specification of AgRMs

Name AgRM4, AgRM5

Form 21 × 21 × 6 mm weight 28 g

Number (for product) 80 pieces/RM

(for homogeneity Test) 15 pieces/RM



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comparison list between tender document and Tanaka's.

	Tender document	TKK
Form	AgRM4 & AgRM5	AgRM4 & AgRM5
Standard dimension	Blocks 21 x 21 x 6 mm	Blocks 21 x 21 x 6 mm
Mass	~ 28 g	~ 28 g
Quantity	>80	>80
Homogeneity Testing		
sample	15	21
Preparation	Prepare both top and bottom surfaces	Milling both top and bottom surface
Test Site	30 test sites (Top & Bottom) × 3	42 test sites (Top & Bottom) × 3
order	Random	Random
Shaving Sample	25 g × 11	25 g × 11

Tanaka made about 10 kg RM each for getting ample products for homogeneity test.
So 21 samples instead of 15 samples to test more available.

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Target concentration

unit(mg/kg)

Elements	AgRM4	AgRM5
Al		10
As	20	40
Au	10	30
Bi	30	10
Ca		10
Cd	10	30
Co	10	
Cr		10
Cu	10	30
Fe	10	30
In	10	
Mg		10
Mn	10	
Ni	10	30
Pb	30	10
Pd	10	30
Pt	10	30
Sb	20	
Se	30	10
Si	10	30
Sn		10
Te	30	10
Zn	10	30

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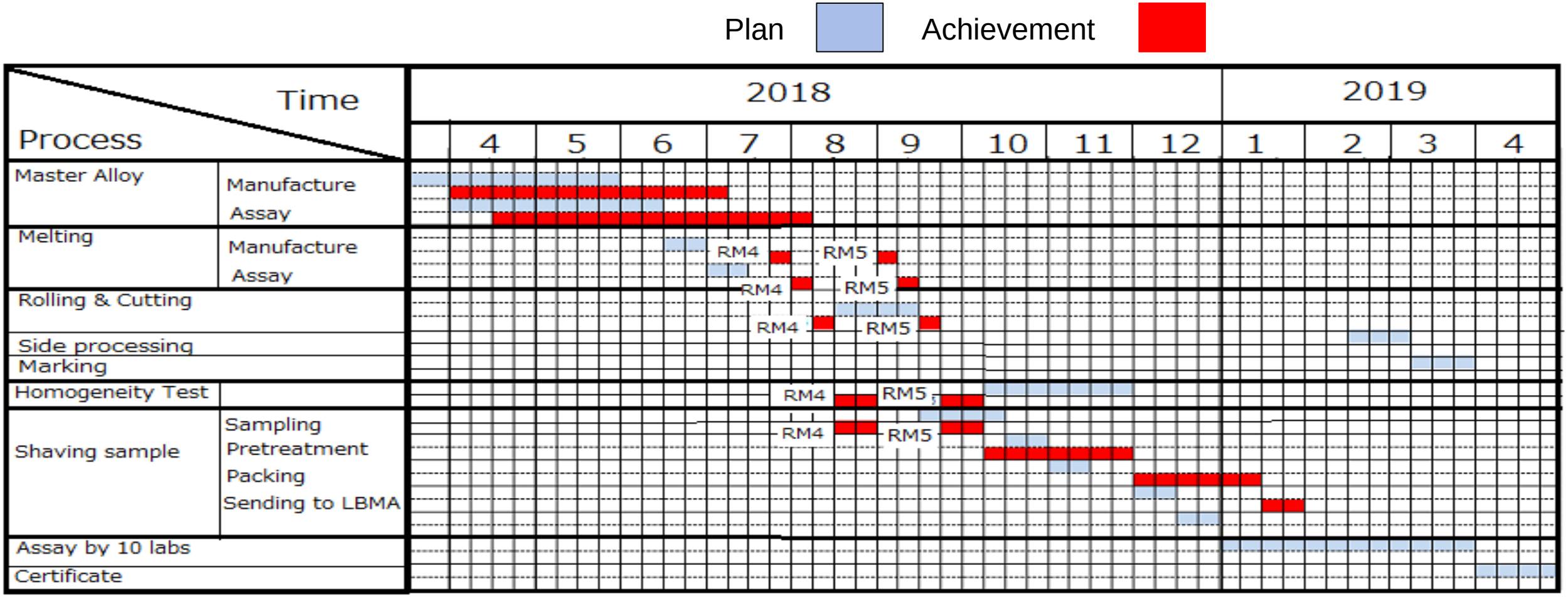
4. Plan & Achievement



We spent more time than expected.
However the schedule is still on the right track.

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5. Manufacturing Master alloys

1. For homogeneous variance of each element, 23 kinds of master alloys were produced.
2. The contents of master alloys were confirmed and validated by XRF and ICP-OES with liquefaction procedure.
3. We have decided the quantity of master alloy in pure silver with the content information of the master alloy.

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6. Melting

Vacuum High-frequency furnace

Carbon mold

Carbon crucible

Pure Ag ingot

+

Master alloys

=

Ag Alloy
10 kg

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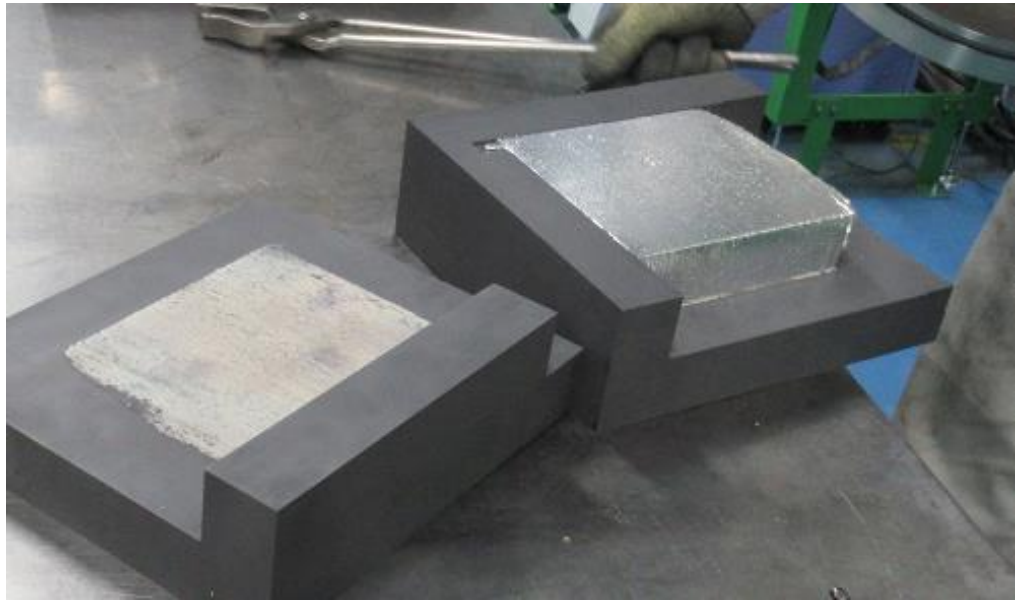
State of melting process



①Charge materials

②Just after melting

③Melted

④Adding alloys

⑤Casting

⑥Ag alloy ingot after casting

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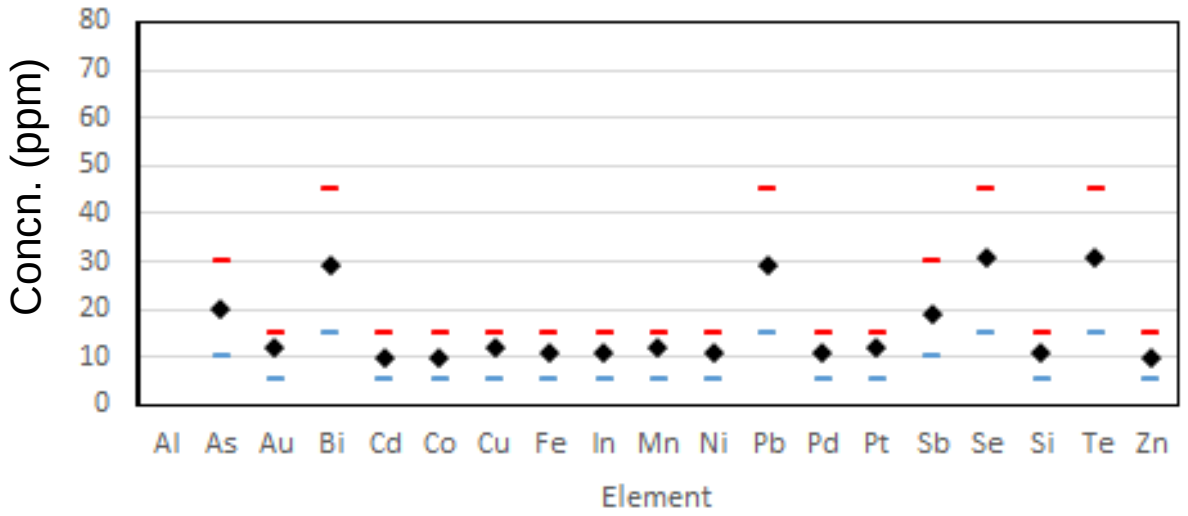
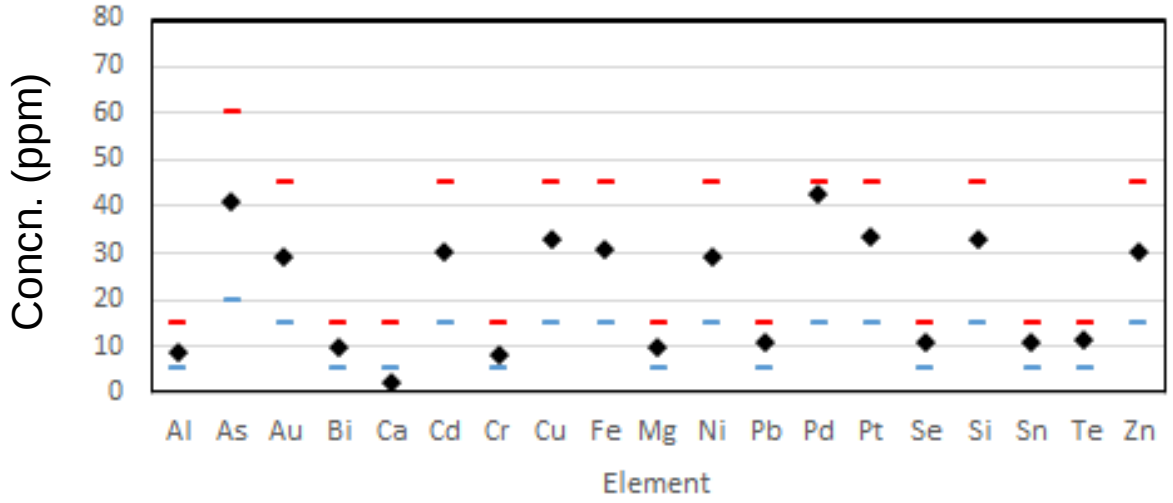
Approximate Element Concentrations in Cast Alloy

AgRM4



AgRM5



- High level
- ◆ Measued value
- Low level

After confirmation of element concentration in cast alloy, we processed to next step.

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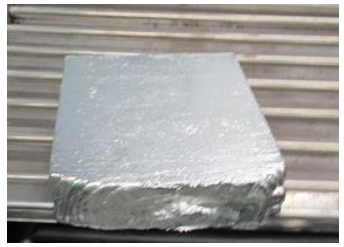
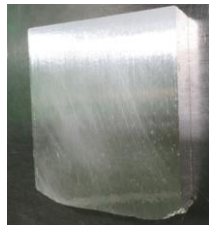
7. Rolling & Cutting

①Shaper

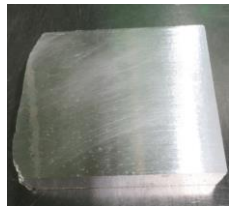


Thickness 40mm



Thickness 36 mm

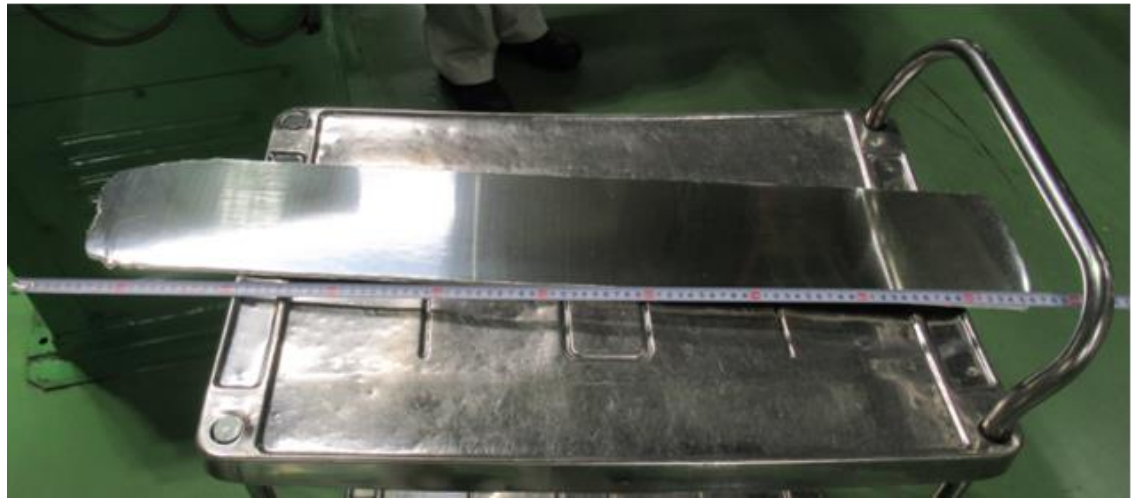
②Rolling



Thickness 36 mm

＋

Correction of curvature



Thickness 6 mm + 1 mm

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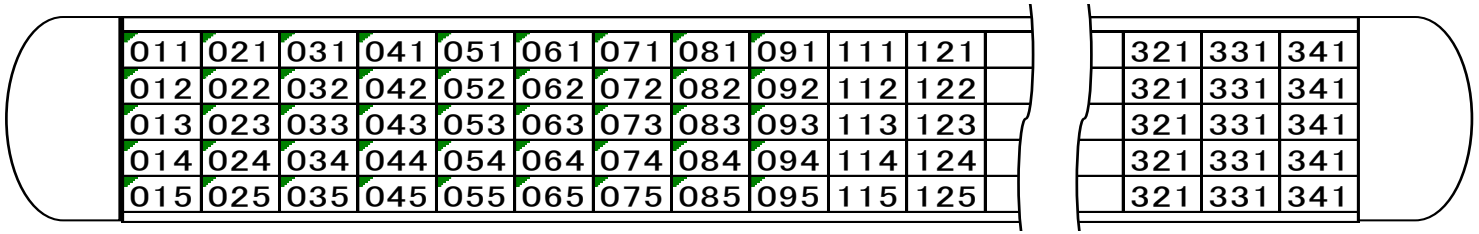
③ Numbering



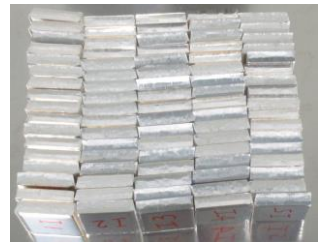
Bottom on mold Top on mold

Marking the cutting position on the surface of the plate to be addressed by using X,Y-Axis.

④ Cutting

Remove parts of the Shrinkage cavity

Cut the plate along long side



Cut into square shape

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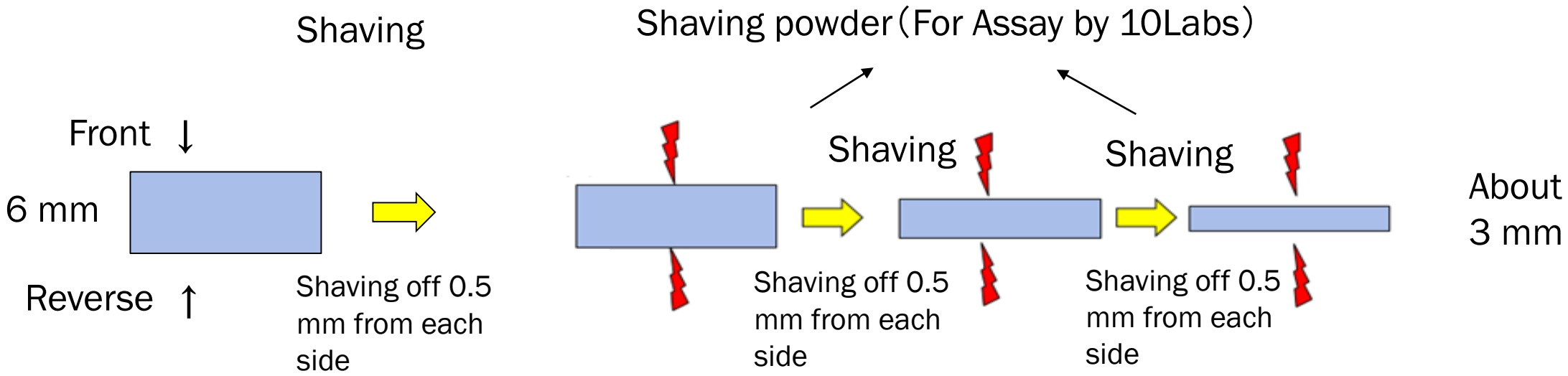
8. Homogeneity Testing

Confirmation of homogeneity



Measurement ①	Measurement ②	Measurement ③
21 samples × 2 face (n=3)	21 samples × 2 face (n=3)	21 samples × 2 face (n=3)

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Sample for homogeneity testing

Row

Bottom

Casting

Shrinkage cavity

	1	2	3	4	5
01	011	012	013	014	015
02	021	022	023	024	025
03	031	032	033	034	035
04	041	042	043	044	045
05	051	052	053	054	055
06	061	062	063	064	065
07	071	072	073	074	075
08	081	082	083	084	085
09	091	092	093	094	095
10	101	102	103	104	105
11	111	112	113	114	115
12	121	122	123	124	125
13	131	132	133	134	135
14	141	142	143	144	145
15	151	152	153	154	155
16	161	162	163	164	165
17	171	172	173	174	175
18	181	182	183	184	185
19	191	192	193	194	195
20	201	202	203	204	205
21	211	212	213	214	215
22	221	222	223	224	225
23	231	232	233	234	235
24	241	242	243	244	245
25	251	252	253	254	255
26	261	262	263	264	265
27	271	272	273	274	275
28	281	282	283	284	285
29	291	292	293	294	295
30	301	302	303	304	305
31	311	312	313	314	315
32	321	322	323	324	325
33	331	332	333	334	335
34	341	342	343	344	Y5

For AgRM4

Red column's samples were used for homogeneity test.

⇒ Total 21 pieces

Others 149 pieces

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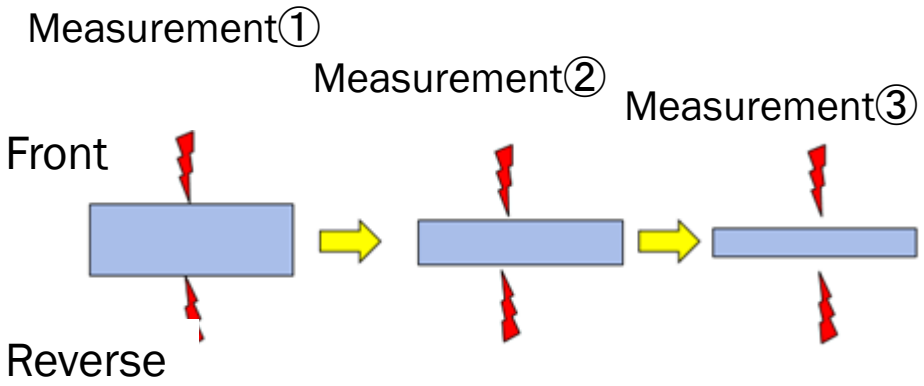
Measurement order

Measurement ①			Measurement ②			Measurement ③			
Order	Sample	Front/Reverce	Order	Sample	Front/Reverce	Order	Sample	Front/Reverce	
1	265	R	1	021	R	1	335	R	←AgRM1,2
2	345	F	2	263	F	2	025	R	
3	261	F	3	265	R	3	025	F	
4	343	R	4	263	R	4	023	F	
5	021	F	5	023	F	5	261	F	
6	013	R	6	023	R	6	011	R	
7	343	F	7	011	R	7	023	R	←AgRM1,2
8	335	F	8	183	R	8	333	R	
9	333	F	9	015	F	9	015	F	
10	013	F	10	105	F	10	343	F	
11	025	R	11	103	R	11	263	F	
12	331	F	12	333	R	12	265	R	
13	103	F	13	101	R	13	101	R	
14	341	F	14	335	R	14	101	F	←AgRM1,2
15	183	F	15	181	R	15	015	R	
16	261	R	16	343	R	16	331	F	
17	18	F	17	105	R	17	265	F	
18	345	R	18	345	F	18	331	R	
19	011	R	19	331	F	19	013	R	
20	263	F	20	335	F	20	333	F	
21	011	F	21	015	R	21	021	R	←AgRM1,2
22	101	R	22	265	F	22	18	R	
23	183	R	23	18	F	23	181	R	
24	025	F	24	013	F	24	103	F	
25	333	R	25	341	R	25	341	F	
26	265	F	26	343	F	26	341	R	
27	105	F	27	341	F	27	021	F	
28	023	R	28	103	F	28	261	R	←AgRM1,2
29	101	F	29	101	F	29	345	R	
30	023	F	30	013	R	30	343	R	
31	331	R	31	331	R	31	185	F	
32	105	R	32	261	F	32	345	F	
33	015	R	33	021	F	33	011	F	
34	263	R	34	181	F	34	105	F	
35	341	R	35	011	F	35	103	R	←AgRM1,2
36	185	R	36	025	R	36	181	F	
37	181	R	37	333	F	37	263	R	
38	181	F	38	345	R	38	183	F	
39	335	R	39	025	F	39	105	R	
40	015	F	40	185	R	40	013	F	
41	021	R	41	183	F	41	335	F	
42	103	R	42	261	R	42	183	R	←AgRM1,2

For homogeneity test, measurement order were randomized.

For reference propose, AgRM1 and 2 were measured after every 7 measurements of the sample.



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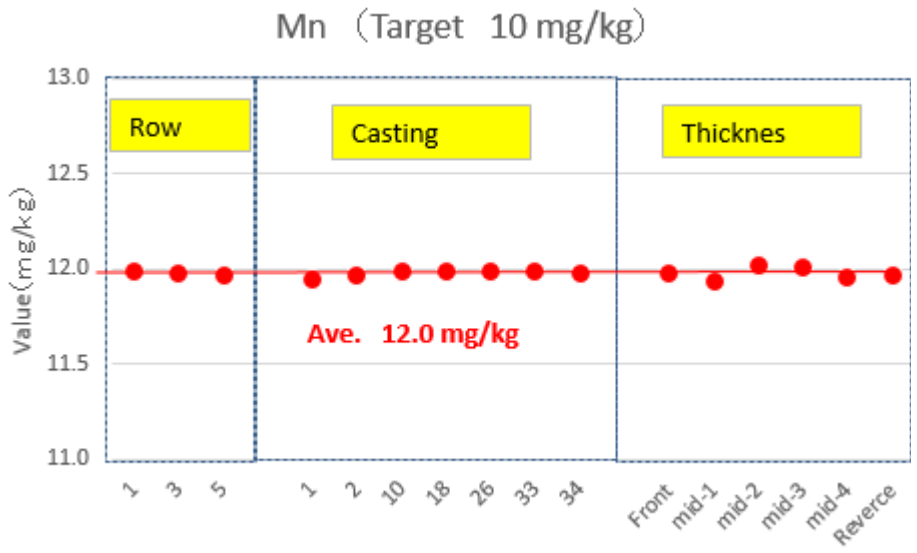
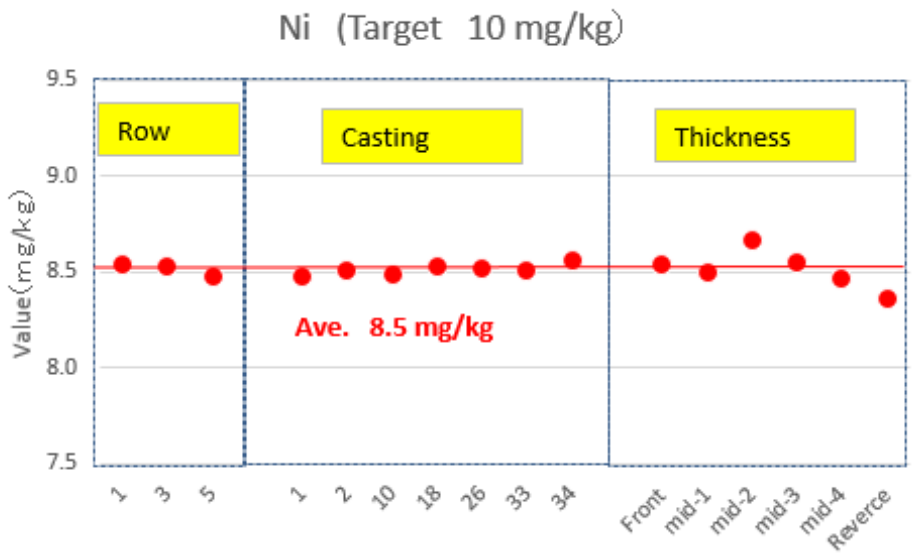
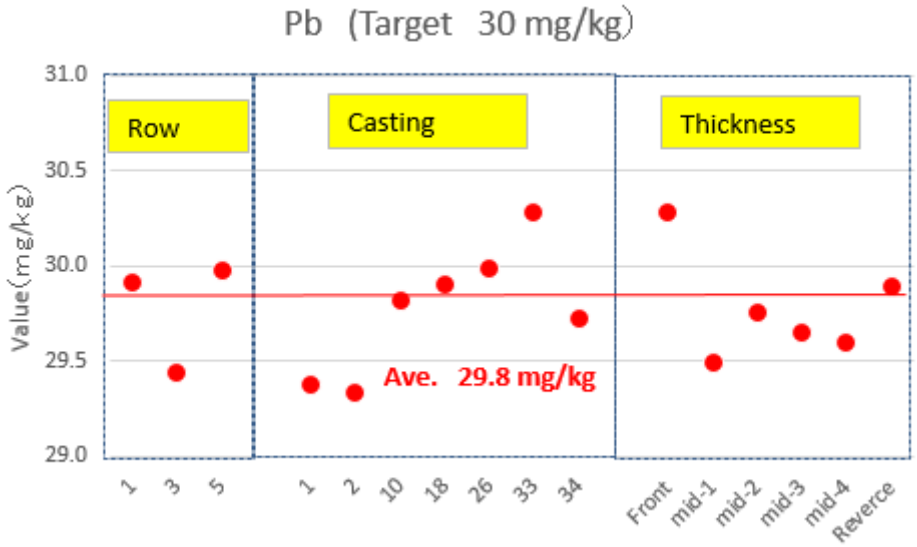
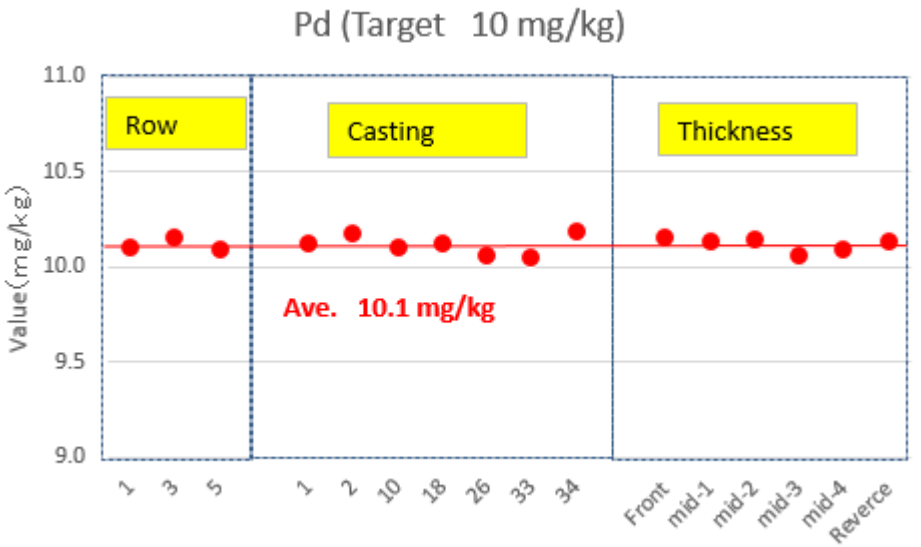
AgRM4 Homogeneity Test









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9. Communication with LBMA

1. October 2018, we reported to LBMA the result of homogeneity data such as QC data (using AgRM1 and 2) and ICP data
2. LBMA CRM Steering Committee of the Project headed by Dr. Mike Hinds reviewed and confirmed the result and permit us to proceed next step.
3. November 2018, LBMA approved the homogeneity of AgRM4 & 5.
4. The pretreatment of shaving sample was advised by LBMA.
5. Tanaka reported the completion of shaving sample and sent them to LBMA for the confirmation of certified value of each element contained in alloys.

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10. Future plan

1. Assay labs (Invited) will analyze shaving sample.
   Collect results: by End April 2019
2. Side face of CRMs will be processed and marked.
   - Side processing : Middle April 2019
   - Marking : Middle May 2019
   - Shipping to LBMA : End May 2019
3. Put on the market : June 2019.

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11. Conclusion

1. LBMA has made a series of CRM of Gold and Silver to supply to GD refiners to help their good assay work improve properly.
2. LBMA CRM Steering Committee headed by Dr. Mike Hinds (Royal Canadian Mint) and consulted by Dr. Stewart Murray(ex. CE of LBMA) has been helping us to proceed with manufacturing work with timely advice.
3. Tanaka strongly believes that we owe to LBMA and its Steering Committee of the project a lot since we had a chance to produce CRMs of Gold and Silver and keep our technology alive and to contribute to the industry.

By having these materials at your plants or assay offices, you will get more confidence on your results by getting a validation of accuracy on your assay method and results.

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