

Test Report

No. : KA/2016/51875

Date : 2016/06/08

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HERAEUS MATERIALS SINGAPORE PTE LTD
BLOCK 5002, ANG MO KIO AVE 5, #04-05, TECHPLACE II, SINGAPORE 569871

The following sample(s) was/were submitted and identified by/on behalf of the applicant as :

Sample Description : GOLD BONDING WIRE
Style/Item No. : AW1, AW6, AW7, AW8, AW9, AW13, AW14, AW21, AW22, AW23, AW24, AW25, AW28, AW29, AW66, AW66i, AW66X, AW99, AW99i, AW99X, Formax, FP2, HA3, HA6, RADIX, RADIXplus and RelMax
Color : GOLD
Sample Receiving Date : 2016/05/30
Testing Period : 2016/05/30 TO 2016/06/08
Sample Submitted By : HERAEUS MATERIALS SINGAPORE PTE LTD

Test Requested

- (1) As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample.
- (2) Please refer to next page(s).

Test Result(s) : Please refer to next page(s).

- (1) Based on the performed tests on submitted samples, the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS and amending Directive (EU) 2015/863.


Ray Chang, Ph.D. / Manager, Test
Signed for and on behalf of
SGS Taiwan Limited
Chemical Laboratory-Kaohsiung



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Test Result(s)

PART NAME No.1 : GOLD BONDING WIRE

Test Item(s)	Unit	Method	MDL	Result	Limit
				No.1	
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5: 2013 and performed by ICP-AES.	2	n.d.	100
Lead (Pb)	mg/kg	With reference to IEC 62321-5: 2013 and performed by ICP-AES.	2	n.d.	1000
Mercury (Hg)	mg/kg	With reference to IEC 62321-4: 2013 and performed by ICP-AES.	2	n.d.	1000
Hexavalent Chromium Cr(VI)	mg/kg	With reference to IEC 62321: 2008 and performed by UV-VIS.	2	n.d.	1000
Hexavalent Chromium Cr(VI)	mg/kg	With reference to US EPA Method 3060A & 7196A for Hexavalent Chromium. Analysis was performed by UV-Vis Spectrometry.	2	n.d.	1000
Hexavalent Chromium Cr(VI)(#2)	µg/cm ²	With reference to IEC 62321-7-1:2015 and performed by UV-VIS.	0.10	n.d.	-
Hexavalent Chromium Cr(VI)	µg/cm ²	With reference to BS EN ISO 3613:2010 for Hexavalent Chromium. Analysis was performed by UV-VIS Spectrometry.	0.02	n.d.	-

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Test Item(s)	Unit	Method	MDL	Result	Limit
				No.1	
Sum of PBBs	mg/kg	With reference to IEC 62321-6: 2015 and performed by GC/MS.	-	n.d.	1000
Monobromobiphenyl			5	n.d.	-
Dibromobiphenyl			5	n.d.	-
Tribromobiphenyl			5	n.d.	-
Tetrabromobiphenyl			5	n.d.	-
Pentabromobiphenyl			5	n.d.	-
Hexabromobiphenyl			5	n.d.	-
Heptabromobiphenyl			5	n.d.	-
Octabromobiphenyl			5	n.d.	-
Nonabromobiphenyl			5	n.d.	-
Decabromobiphenyl			5	n.d.	-
Sum of PBDEs			mg/kg	With reference to IEC 62321-6: 2015 and performed by GC/MS.	-
Monobromodiphenyl ether	5	n.d.			-
Dibromodiphenyl ether	5	n.d.			-
Tribromodiphenyl ether	5	n.d.			-
Tetrabromodiphenyl ether	5	n.d.			-
Pentabromodiphenyl ether	5	n.d.			-
Hexabromodiphenyl ether	5	n.d.			-
Heptabromodiphenyl ether	5	n.d.			-
Octabromodiphenyl ether	5	n.d.			-
Nonabromodiphenyl ether	5	n.d.			-
Decabromodiphenyl ether	5	n.d.			-

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Test Item(s)	Unit	Method	MDL	Result	Limit
				No.1	
Antimony (Sb)	mg/kg	With reference to US EPA Method 3052 for Antimony Content. Analysis was performed by ICP-AES.	2	n.d.	-
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α - HBCDD, β - HBCDD, γ - HBCDD) (CAS No.: 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8))	mg/kg	With reference to IEC 62321: 2008 method. Analysis was performed by GC/MS.	5	n.d.	-
Tetrabromobisphenol A (TBBP-A) (CAS No.: 79-94-7)	mg/kg	With reference to RSTS-E&E-121. Analysis was performed by LC/MS.	10	n.d.	-
Perfluorooctane sulfonates (PFOS)	mg/kg	With reference to US EPA 3550C: 2007. Analysis was performed by LC/MS.	10	n.d.	-
PFOA (CAS No.: 335-67-1)	mg/kg	With reference to US EPA 3550C: 2007. Analysis was performed by LC/MS.	10	n.d.	-
Halogen					
Halogen-Fluorine (F) (CAS No.: 14762-94-8)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC.	50	n.d.	-
Halogen-Chlorine (Cl) (CAS No.: 22537-15-1)			50	n.d.	-
Halogen-Bromine (Br) (CAS No.: 10097-32-2)			50	n.d.	-
Halogen-Iodine (I) (CAS No.: 14362-44-8)			50	n.d.	-

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Test Item(s)	Unit	Method	MDL	Result	Limit
				No.1	
Phthalates					
BBP (Butyl Benzyl phthalate) (CAS No.: 85-68-7)	mg/kg	With reference to IEC 62321-8 (111/321/CD). Analysis was performed by GC/MS.	50	n.d.	1000
DBP (Dibutyl phthalate) (CAS No.: 84-74-2)			50	n.d.	1000
DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7)			50	n.d.	1000
DIBP (Di-isobutyl phthalate) (CAS No.: 84-69-5)			50	n.d.	1000
DIDP (Di-isodecyl phthalate) (CAS No.: 26761-40-0; 68515-49-1)			50	n.d.	-
DINP (Di-isononyl phthalate) (CAS No.: 28553-12-0; 68515-48-0)			50	n.d.	-
DNOP (Di-n-octyl phthalate) (CAS No.: 117-84-0)			50	n.d.	-
DMEP (Bis (2-methoxyethyl) phthalate) (CAS No.: 117-82-8)			50	n.d.	-
DNHP (Di-n-hexyl phthalate) (CAS No.: 84-75-3)			50	n.d.	-

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Note :

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. n.d. = Not Detected
3. MDL = Method Detection Limit
4. " - " = Not Regulated
5. Method Detection Limit = 0.02 $\mu\text{g}/\text{cm}^2$.
6. (#2) =
 - a. The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13 $\mu\text{g}/\text{cm}^2$.
The sample coating is considered to contain Cr(VI)
 - b. The sample is negative for Cr(VI) if Cr(VI) is n.d. (concentration less than 0.10 $\mu\text{g}/\text{cm}^2$).
The coating is considered a non-Cr(VI) based coating
 - c. The result between 0.10 $\mu\text{g}/\text{cm}^2$ and 0.13 $\mu\text{g}/\text{cm}^2$ is considered to be inconclusive - unavoidable coating variations may influence the determination.

PFOS Reference Information : POPs - (EU) 757/2010

Outlawing PFOS as substances or preparations in concentrations above 0.001% (10ppm), in semi-finished products or articles or parts at a level above 0.1%(1000ppm), in textiles or other coated materials above 1 $\mu\text{g}/\text{m}^2$.

PFOS refer to Perfluorooctanesulfonic acid and its derivatives including Perfluorooctanesulfonic acid, Perfluorooctane sulfonamide, N-Methylperfluorooctane sulfonamide, N-Ethylperfluorooctane sulfonamide, N-Methylperfluorooctane sulfonamidoethanol and N-Ethylperfluorooctane sulfonamidoethanol.

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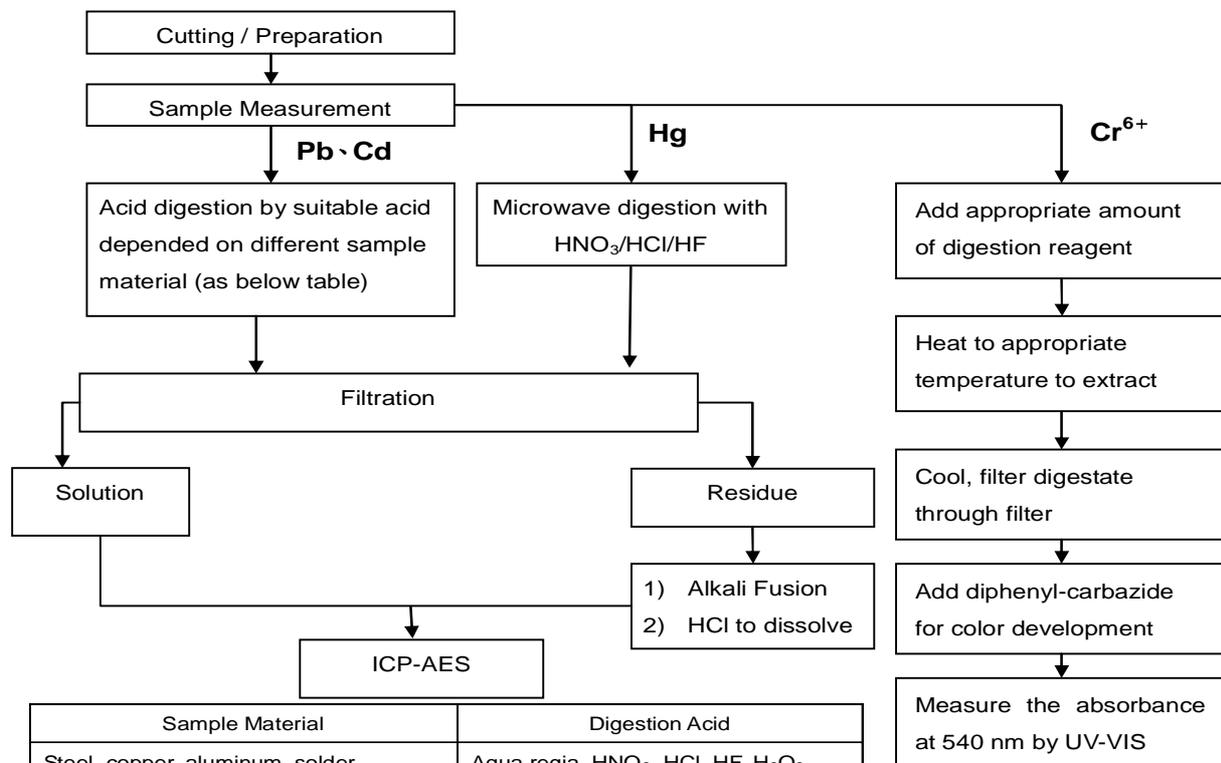
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HERAEUS MATERIALS SINGAPORE PTE LTD

BLOCK 5002, ANG MO KIO AVE 5, #04-05, TECHPLACE II, SINGAPORE 569871

- 1) These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr⁶⁺ test method excluded)
- 2) Name of the person who made measurement: Jony Liu
- 3) Name of the person in charge of measurement: Ray Chang



Sample Material	Digestion Acid
Steel, copper, aluminum, solder	Aqua regia, HNO ₃ , HCl, HF, H ₂ O ₂
Glass	HNO ₃ /HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO ₃
Plastic	H ₂ SO ₄ , H ₂ O ₂ , HNO ₃ , HCl
Others	Any acid to total digestion

Note :** (1) For non-metallic material, add alkaline digestion reagent and heat to 90~95 °C.
 (2) For metallic material, add pure water and heat to boiling.

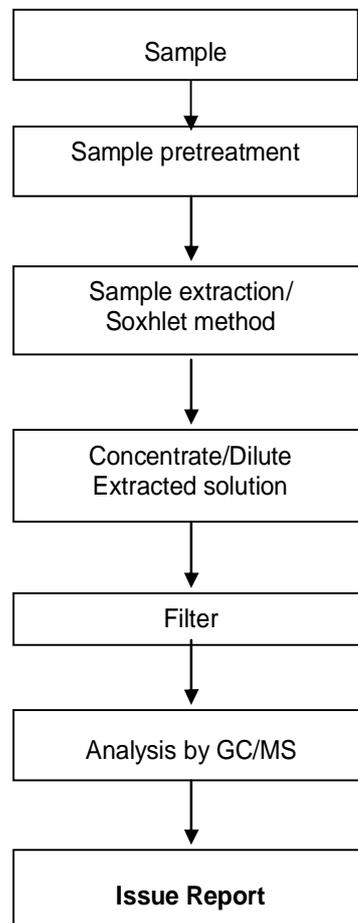
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HERAEUS MATERIALS SINGAPORE PTE LTD

BLOCK 5002, ANG MO KIO AVE 5, #04-05, TECHPLACE II, SINGAPORE 569871

PBB/PBDE analytical FLOW CHART

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang



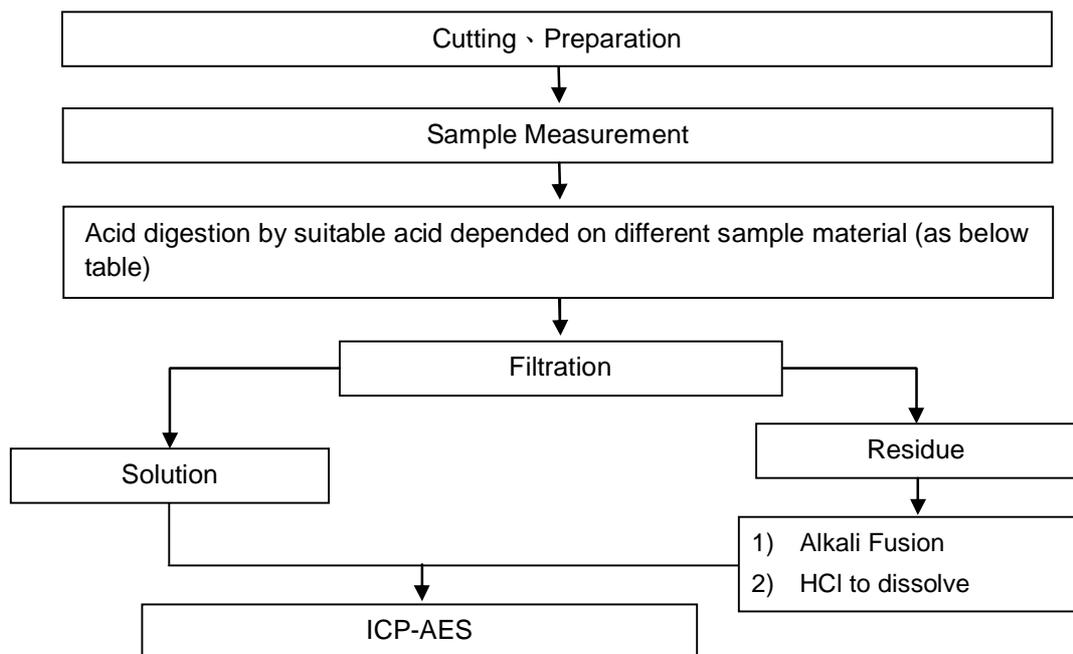
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BLOCK 5002, ANG MO KIO AVE 5, #04-05, TECHPLACE II, SINGAPORE 569871

- 1) These samples were dissolved totally by pre-conditioning method according to below flow chart.
- 2) Name of the person who made measurement: Jony Liu
- 3) Name of the person in charge of measurement: Ray Chang

Flow Chart of digestion for the elements analysis performed by ICP-AES



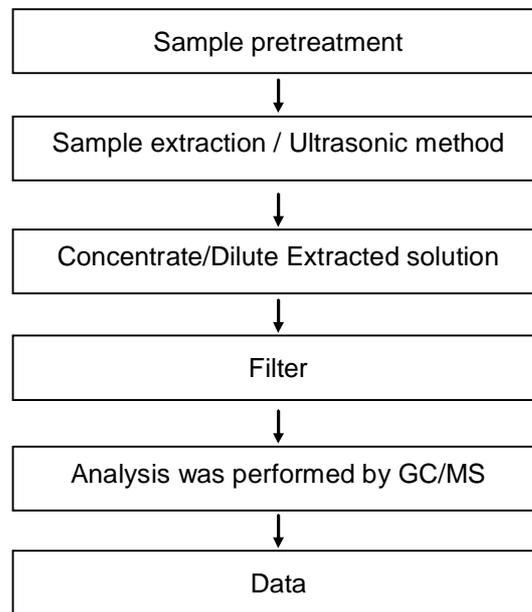
Steel, copper, aluminum, solder	Aqua regia, HNO ₃ , HCl, HF, H ₂ O ₂
Glass	HNO ₃ /HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO ₃
Plastic	H ₂ SO ₄ , H ₂ O ₂ , HNO ₃ , HCl
Others	Any acid to total digestion

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HBCDD analytical flow chart

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang



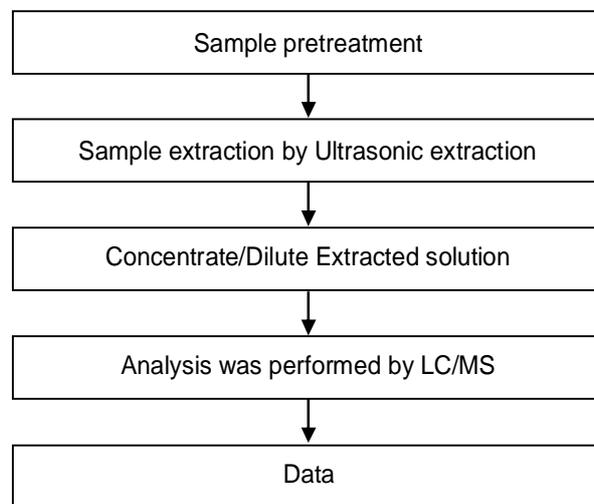
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BLOCK 5002, ANG MO KIO AVE 5, #04-05, TECHPLACE II, SINGAPORE 569871

TBBP-A analytical flow chart

- Name of the person who made measurement: Ginny Huang
- Name of the person in charge of measurement: Ray Chang



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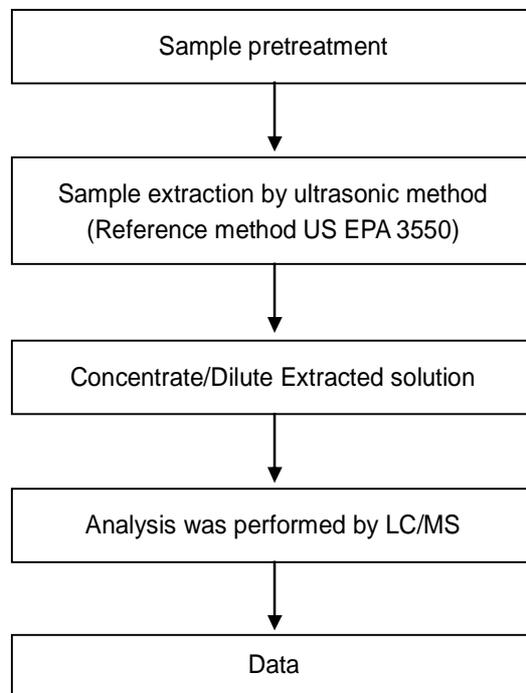
HERAEUS MATERIALS SINGAPORE PTE LTD

BLOCK 5002, ANG MO KIO AVE 5, #04-05, TECHPLACE II, SINGAPORE 569871

Analytical flow chart of PFOA/PFOS content

1) Name of the person who made measurement: Ginny Huang

2) Name of the person in charge of measurement: Ray Chang



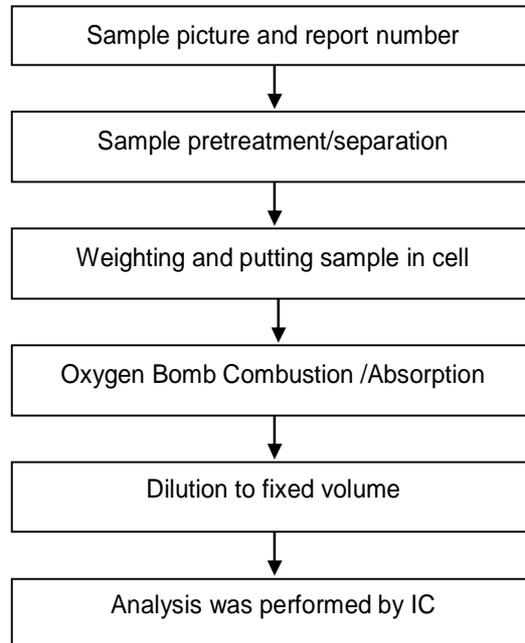
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Analytical flow chart of halogen content

- 1) Name of the person who made measurement: Jean Hung
- 2) Name of the person in charge of measurement: Ray Chang



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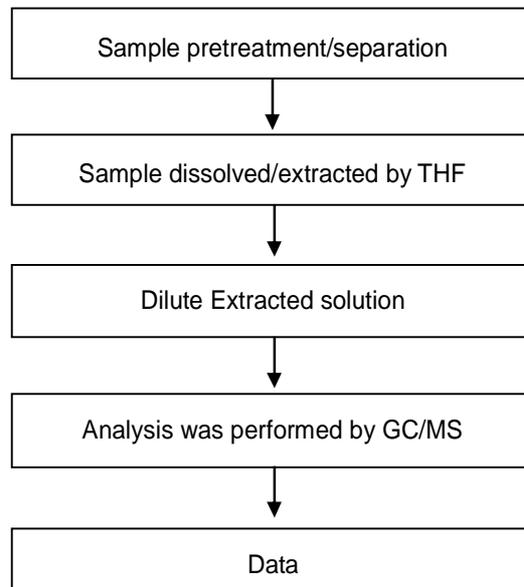
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Analytical flow chart of phthalate content

- Name of the person who made measurement: Dorothy Chen
- Name of the person in charge of measurement: Ray Chang

【Test method: IEC 62321-8】



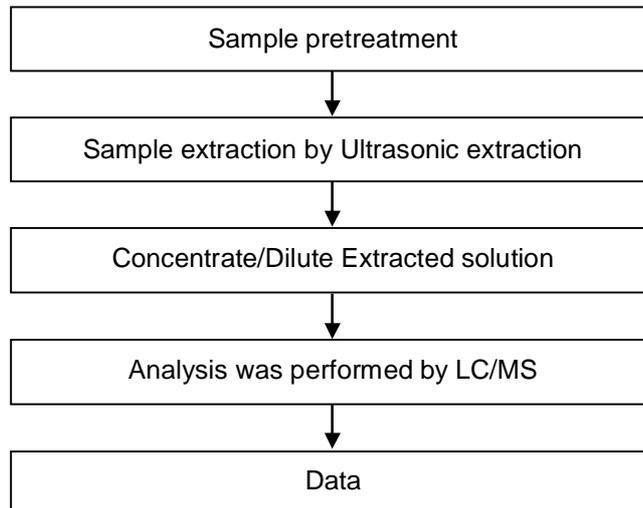
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TBBP-A analytical flow chart

- Name of the person who made measurement: Ginny Huang
- Name of the person in charge of measurement: Ray Chang



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Test Report

No. : KA/2016/51875

Date : 2016/06/08

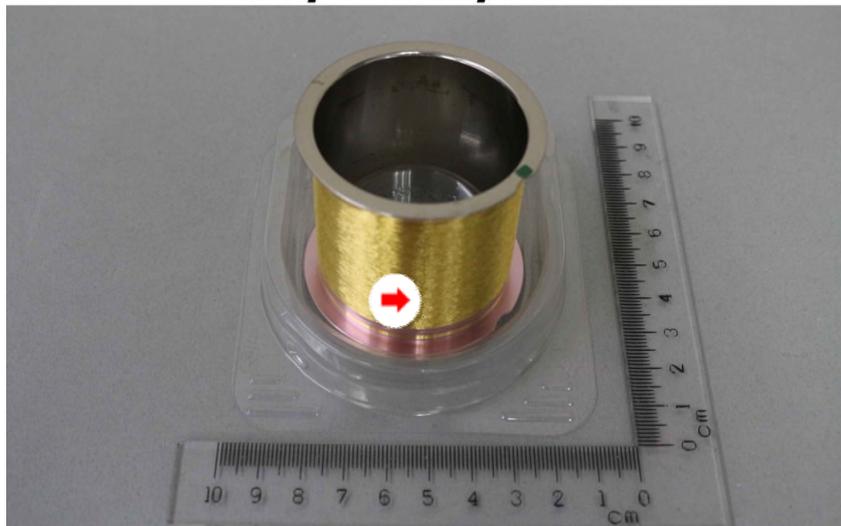
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* The tested sample / part is marked by an arrow if it's shown on the photo. *

KA/2016/51875



** End of Report **

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