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HERAEUS MATERIALS SINGAPORE PTE LTD BLK 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 Submitted I Sample Name Style/Item No.	Ву	:	HERAEUS MATERIALS SINGAPORE PTE LTD Palladium Coated Copper Bonding Wire Pdsoft and PdPRo
Sample Receiving D Testing Period	ate	:	08-Apr-2021 08-Apr-2021 to 22-Apr-2021
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(s). Please refer to next pages for the other item(s).
Test Results Conclusion	:	(2)	Please refer to following pages. Based on the performed tests on submitted sample(s), the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with
			the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Ray Chang, Ph.D./Departthe tivianage Signed for and on behalt

Chemical Laboratory-Kaohsiung

SĞS TAIWAN LTD.



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SGS Taiwan Ltd. 台灣檢驗科技股份有限公司



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HERAEUS MATERIALS SINGAPORE PTE LTD

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

Test Part Description

No.1 : Palladium Coated Copper Bonding Wire

Test Result(s)

Test Item(s)	Method	Unit	MDL	Result	Limit
				No.1	
Cadmium (Cd) (CAS No.: 7440-43-9)	With reference to IEC 62321-5: 2013,	mg/kg	2	n.d.	100
	analysis was performed by ICP-OES.				
Lead (Pb) (CAS No.: 7439-92-1)	With reference to IEC 62321-5: 2013,	mg/kg	2	n.d.	1000
	analysis was performed by ICP-OES.				
Mercury (Hg) (CAS No.: 7439-97-6)	With reference to IEC 62321-4: 2013+	mg/kg	2	n.d.	1000
	AMD1: 2017, analysis was performed				
	by ICP-OES.				
Hexavalent Chromium Cr(VI) (CAS No.:	With reference to IEC 62321-7-2:	mg/kg	8	n.d.	-
18540-29-9)	2017, analysis was performed by UV-				
	VIS.				
Hexavalent Chromium Cr(VI) (CAS No.:	With reference to IEC 62321-7-1:	µg/cm²	0.1	n.d.	-
18540-29-9) (#2)	2015, analysis was performed by UV-				
	VIS.				
Hexavalent Chromium Cr(VI) (CAS No.:	With reference to ISO 3613: 2010,	µg/cm²	0.02	n.d.	-
18540-29-9)	analysis was performed by UV-VIS.				
Hexavalent Chromium Cr(VI) (CAS No.:	With reference to US EPA 3060A:	mg/kg	2	n.d.	-
18540-29-9)	1996, analysis was performed by UV-				
	Vis.				
Monobromobiphenyl		mg/kg	5	n.d.	-
Dibromobiphenyl		mg/kg	5	n.d.	-
Tribromobiphenyl		mg/kg	5	n.d.	-
Tetrabromobipenyl		mg/kg	5	n.d.	-
Pentabromobiphenyl	With reference to IEC 62321-6: 2015,	mg/kg	5	n.d.	-
Hexabromobiphenyl	analysis was performed by GC/MS.	mg/kg	5	n.d.	-
Heptabromobiphenyl	analysis was performed by GC/WS.	mg/kg	5	n.d.	-
Octabromobiphenyl]	mg/kg	5	n.d.	-
Nonabromobiphenyl]	mg/kg	5	n.d.	-
Decabromobiphenyl]	mg/kg	5	n.d.	-
Sum of PBBs		mg/kg	-	n.d.	1000

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

Test Item(s)	Method	Unit	MDL	Result	Limit
				No.1	
Monobromodiphenyl ether		mg/kg	5	n.d.	-
Dibromodiphenyl ether		mg/kg	5	n.d.	-
Tribromodiphenyl ether		mg/kg	5	n.d.	-
Tetrabromodiphenyl ether		mg/kg	5	n.d.	-
Pentabromodiphenyl ether	With reference to IEC 62321-6: 2015, analysis was performed by GC/MS.	mg/kg	5	n.d.	-
Hexabromodiphenyl ether		mg/kg	5	n.d.	-
Heptabromodiphenyl ether		mg/kg	5	n.d.	-
Octabromodiphenyl ether		mg/kg	5	n.d.	-
Nonabromodiphenyl ether		mg/kg	5	n.d.	-
Decabromodiphenyl ether		mg/kg	5	n.d.	-
Sum of PBDEs		mg/kg	-	n.d.	1000
Butyl benzyl phthalate (BBP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	1000
85-68-7)	analysis was performed by GC/MS.				
Dibutyl phthalate (DBP) (CAS No.: 84-	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	1000
74-2)	analysis was performed by GC/MS.				
Diisobutyl phthalate (DIBP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	1000
84-69-5)	analysis was performed by GC/MS.				
Di-(2-ethylhexyl) phthalate (DEHP)	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	1000
(CAS No.: 117-81-7)	analysis was performed by GC/MS.				
Diisononyl phthalate (DINP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	-
28553-12-0, 68515-48-0)	analysis was performed by GC/MS.				
Diisodecyl phthalate (DIDP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	-
26761-40-0, 68515-49-1)	analysis was performed by GC/MS.				
Di-n-octyl phthalate (DNOP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	-
117-84-0)	analysis was performed by GC/MS.				
Di-n-pentyl phthalate (DNPP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	-
131-18-0)	analysis was performed by GC/MS.	5 5			
Di-n-hexyl phthalate (DNHP) (CAS No.:	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	-
84-75-3)	analysis was performed by GC/MS.	<u> </u>			
Bis-(2-methoxyethyl) phthalate (DMEP)	With reference to IEC 62321-8: 2017,	mg/kg	50	n.d.	-
(CAS No.: 117-82-8)	analysis was performed by GC/MS.	J. J			
Tetrabromobisphenol A (TBBP-A) (CAS	With reference to RSTS-E&E-121,	mg/kg	10	n.d.	-
No.: 79-94-7)	analysis was performed by LC/MS.	و ،ر			

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HERAEUS MATERIALS SINGAPORE PTE LTD

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

Test Item(s)	Method	Unit	MDL	Result No.1	Limit
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α - HBCDD, β - HBCDD, γ - HBCDD) (CAS No.: 25637-99-4, 3194- 55-6 (134237-51-7, 134237-50-6, 134237-52-8))	With reference to IEC 62321: 2008, analysis was performed by GC/MS.	mg/kg	5	n.d.	-
Fluorine (F) (CAS No.: 14762-94-8)	With reference to BS EN 14582: 2016, analysis was performed by IC.	mg/kg	50	n.d.	-
Chlorine (Cl) (CAS No.: 22537-15-1)	With reference to BS EN 14582: 2016, analysis was performed by IC.	mg/kg	50	n.d.	-
Bromine (Br) (CAS No.: 10097-32-2)	With reference to BS EN 14582: 2016, analysis was performed by IC.	mg/kg	50	n.d.	-
lodine (I) (CAS No.: 14362-44-8)	With reference to BS EN 14582: 2016, analysis was performed by IC.	mg/kg	50	n.d.	-
Antimony (Sb) (CAS No.: 7440-36-0)	With reference to US EPA 3052: 1996, analysis was performed by ICP-OES.	mg/kg	2	n.d.	-
Perfluorooctanoic acid (PFOA) and it's salt (CAS No.: 335-67-1 and its salts)	With reference to CEN/TS 15968:	mg/kg	0.01	n.d.	-
Perfluorooctane sulfonate (PFOS) and it's salt (CAS No.: 1763-23-1 and its salts)	2010, analysis was performed by LC/MS/MS.	mg/kg	0.01	n.d.	-

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Note :

- 1. mg/kg = ppm ; 0.1wt% = 1000ppm
- 2. MDL = Method Detection Limit
- 3. n.d. = Not Detected (Less than MDL)
- 4. "-" = Not Regulated
- 5. PFOS and its salts including : CAS No.: 29081-56-9, 2795-39-3, 29457-72-5, 70225-14-8, 56773-42-3, 251099-16-8, 307-35-7.
- 6. PFOA and its salts including : CAS No.: 3825-26-1, 335-95-5, 2395-00-8, 335-93-3, 335-66-0.
- 7. (#2) =

a. The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13 µg/cm². 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 µg/cm²). The coating is considered a non-Cr(VI) based coating

c. The result between 0.10 µg/cm² and 0.13 µg/cm² is considered to be inconclusive - unavoidable coating variations may influence the determination.

8. The statement of compliance conformity is based on comparison of testing results and limits.

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

Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr⁶⁺

Cutting · Preparation Sample Measurement Cr⁶⁺ Pb/Cd/Hg Acid digestion with microwave / hotplate Non-metal Metal ABS/PC/PVC Others Filtration Boiling water extraction Dissolving by Digesting at ultrasonication 150~160°C Solution Residue Cool, filter ╈ digestate through Separating to get Digesting at 60°C filter (1) Alkali fusion by Itrasonication (2) HCI to dissolve aqueous phase Add diphenylcarbazide for color development **ICP-OES** pH adjustment Measure the Add diphenyl-carbazide for absorbance at 540 color development nm by UV-VIS Measure the absorbance at 540 nm by UV-VIS

test method excluded)

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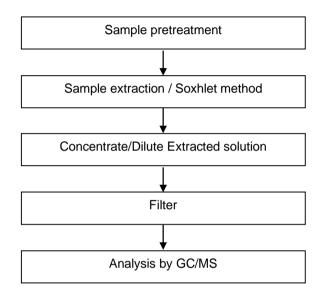
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PBB/PBDE analytical FLOW CHART



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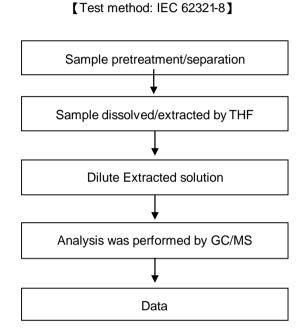
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Analytical flow chart of phthalate content



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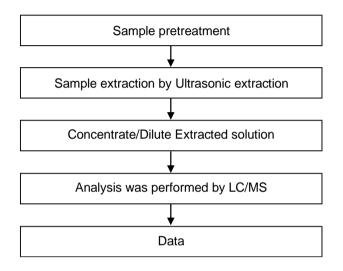
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TBBP-A analytical flow chart



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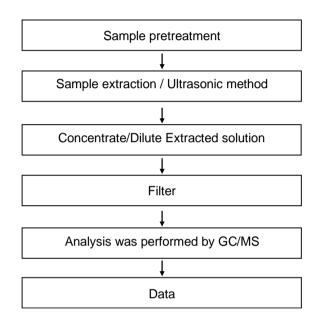
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Analytical flow chart - HBCDD



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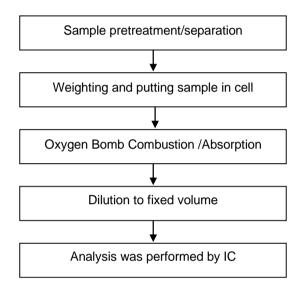
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Analytical flow chart of Halogen



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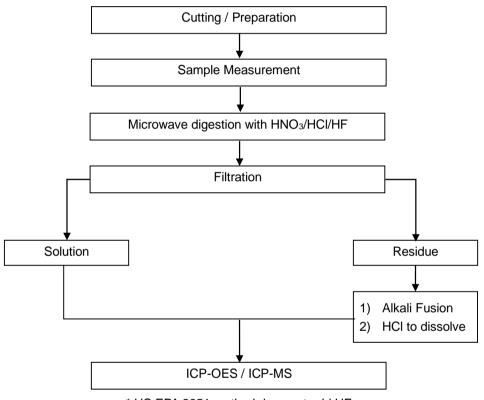
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Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart. [Reference method : US EPA 3051 \ US EPA 3052]



* US EPA 3051 method does not add HF.

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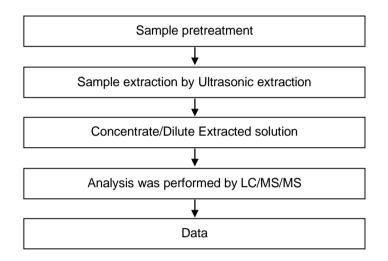
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Analytical flow chart - PFOA/PFOS



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



** End of Report **

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