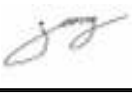
자재시방서(승인원)

기안자	강윤우 연구원/연구2팀 (032-650-6276)
완료일	2012-06-04 11:45:30 AM

작성부서	기안	그룹장	팀장
	강윤우	곽귀동	유종은
			
	06-01 08:38	06-01 10:20	06-04 11:30

주관부서	사원
	정성엽
	
	06-04 11:45

문서번호	A연2613-0976-영(수시)		
이관함	승인원	공개 범위	사업담당 R&D센터 연구2팀
수신처	중국법인지원팀,구매3팀,구매1팀,구매2팀		
참조자	kuens, 강성모, 고만석, 김경성, 김경택, 김동현, 문형필, 안병준, 오철규, 이광열, 이기영, 정대혁, 정태희, 최민규		
문서제목	E606-00006-002-0S		

자 재 코 드	E606000060020S
자 재 명	ANTENNA,MODULE
규 격	ABM6020B2 BLUETOOTH CHIP ANT SMD(6*2)

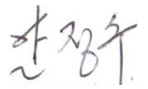
모 델 명	SA-SWR3		
설계변경 NO	REV NO.	일자	내 용
중점 Check 사항			
환경문서번호			
검 사 방 식	수입검사 규칙(B0-B701-01)에 준하여 검사할 것.		
구 입 방 법	■ 내수 □ LOCAL □ 수입		
협력업체명	ARRO	제조업체명	ARRO
첨 부 자 료	■ 협력업체승인원 □ 도면 □ 검사성적서 □ 유해물질 불사용 확인서 □ 부품재질별 성적서		
첨부파일경로	HTTP://HTE4SVR2.INKEL.CO.KR/WEBDIR/APPROVAL/E606-00006-002-0S.PDF		

※ 첨부파일 경로 예시 : HTTP://HTE4SVR2.INKEL.CO.KR/WEBDIR/APPROVAL/자재코드.PDF

IMS-B101-07/01(1)

개발 단가		부품 타입	SMD	LIB	

안테나 부품 승인원

결재	담 당	품질팀장	개발팀장	승 인
				
	이승찬	조병환	이승효	남정수
	5/8	5/8	5/8	5/8

BUYER	인켈
모 델 명	UPPER
부 품 명	BLUETOOTH CHIP ANTENNA
부품코드	
아로코드	ABM6020B2

경기도 안양시 만안구 안양7동 205-11
TEL : 031)448-8172 / FAX : 031)448-4194

아로 주식회사

- 목 차 -

12. 포장 사양

12.1 Carrier 및 Reel 사양

12.2 박스 포장 사양

*** 부품 구성표, 유해물질 성적서 별첨**

안테나 승인원		DATE	2012. 05. 08	REV.	1.0
MODEL	UPPER	TYPE	BLUETOOTH CHIP	4/24	4/23

1. 승인원 이력 LIST

NO	일자	변경 전	변경 후	근거 사유	REV
1	2012.05.08			ANTENNA 단품도면 신작	1.0
2					
3					
4					
5					

※ 상기 REV.은 승인 후 양산중의 변경사항에 대해서만 REVISION 변경 함.
개발중의 변경사항에 대해서는 REVISION 변경 없음.

2. 제품사양

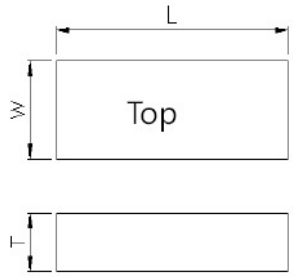
2.1 재질 증명서

구분	균질재질명	조성물질명	가공처리	원소재업체	가공업체	재료상태	비 고
1	POLYMER	480R	Tape 성형	ZEONEX	아로㈜	RESIN	
2	POWDER	strontium titanate	Tape 성형	FERRO	아로㈜	POWDER	
3	PREPLEG	GLASS FIBER	적층	DOOSAN	써키트로닉스	SHEET	두께 : 0.1mm
4	Cu Foil	Cu	적층	LS산전	써키트로닉스	Foil	두께 : 0.018mm
5	PSR	Epoxy acrylate pligomer	인쇄	서울화학	써키트로닉스	INK	
6	Ni Plate	Ni	도금	오알캠	써키트로닉스	용액	두께 Ni 3um 이상
7	Au Plate	Au	도금	오알캠	써키트로닉스	용액	두께 Au 0.03㎛ 이상

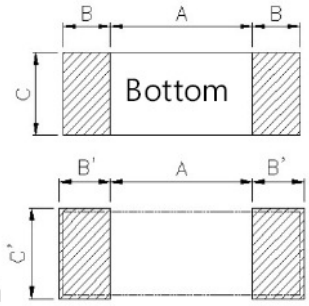
2.2 치수 규격

➢ Mechanical Dimension

Chip Antenna Dimension

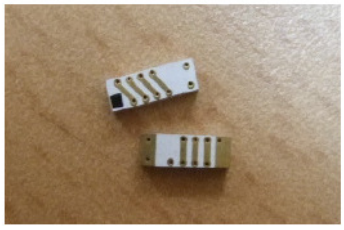


Chip Antenna Soldering Pad Dimension



L	6.0
W	2.0
T	1.5
A	4.3
B	1.0
C	2.0
B'	1.1
C'	2.2

Chip Antenna Real Product



(unit : mm , tolerance : ± 0.1)

3. 기술적 사항

3.1 일반적 사양

MODEL	UPPER
ANTENNA TYPE	B.T CHIP ANTENNA
APPLICATIONS	Wi-Fi

3.2 전기적 사양

FREQUENCY RANGE[MHz] (SET MEASUREMENT)	2,400~2483 MHz	
MEASUREMENT FREQUENCY POINT[MHz] (SET MEASUREMENT)	2,400	2,483
V.S.W.R (SET MEASUREMENT)	MAX 1.5	MAX 1.6
TOTAL GAIN(PEAK/AVG)[dBi](F/O)	3.8/-5.6	
INPUT IMPEDANCE(Ω)	50 Ohm	
POLARIZATION	LINEAR	
RADIATION PATTERN	OMNIDIRECTIONAL	

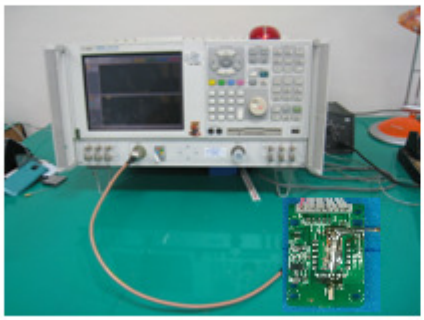
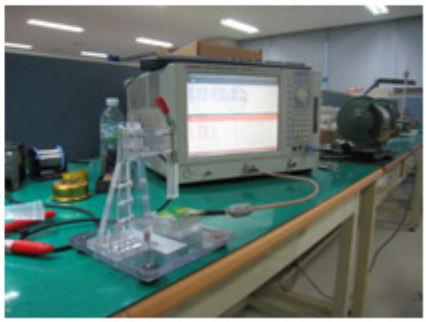
3.3 기구적 사양

CONNECTOR	N/A
LENGTH	REF DRAWING (No 6.1)
TEMPERATURE	-20 ~ 70(℃)
WEIGHT	0.1(g)

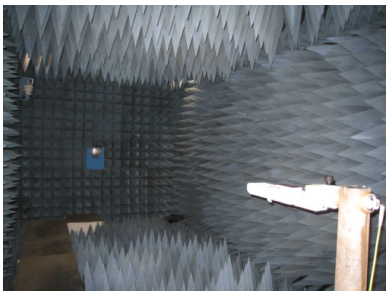
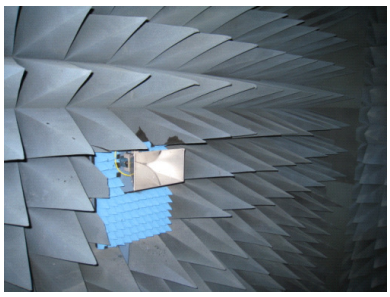
4. 시험 조건

4.1 시험 환경 조건 및 시험 장비

4.1.1 SWR/Return Loss
Network Analyzer를 이용하여 SWR/Return Loss를 측정하여 표본 샘플을 선별, 수동 측정 지그 또는 자동화 검사 장비를 이용하여 양품과 불량품을 선별한다.

	시료 측정 조건	수동 지그 측정 조건
Network Analyzer	Agilent E8358A	Advantest R3768
cable	RF cable(300 mm)	RF cable(300 mm)
Test condition		

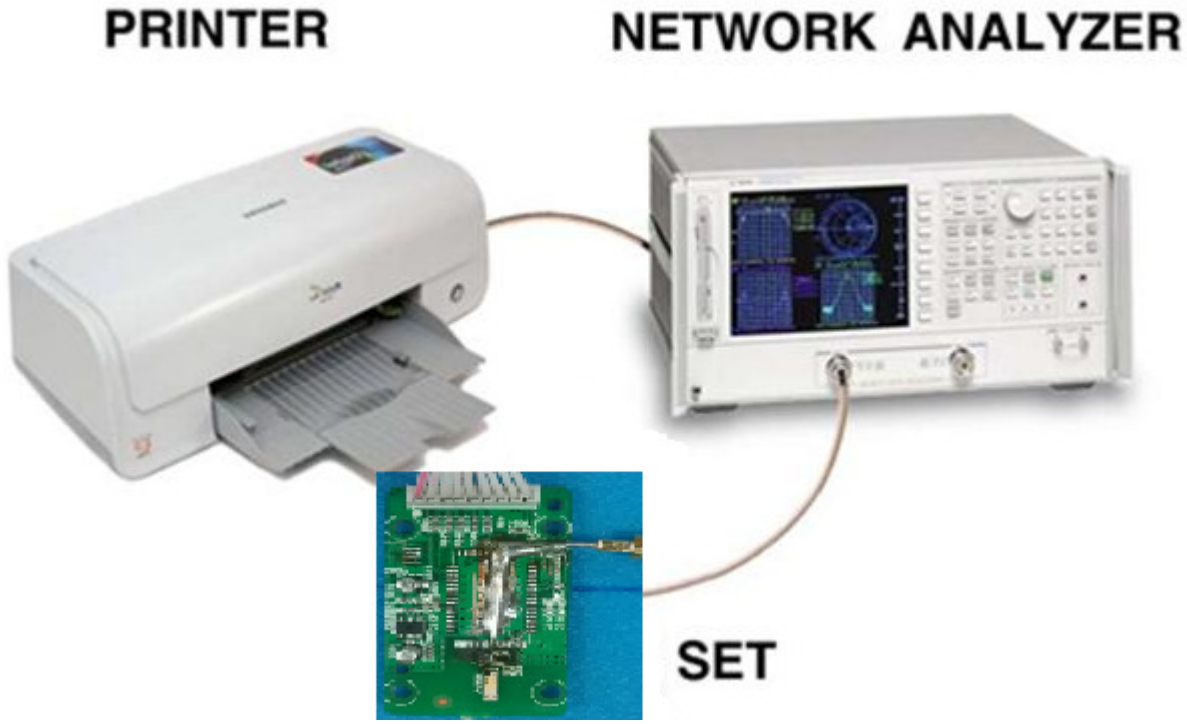
4.1.2 이득
당사가 보유한 무반사실에서 상기 4.1.1 에서 측정된 시료를 이용하여 안테나 이득을 측정한다.

안테나 측정을 위한 무반사실	
	
	

5. 전기적 요구 사항

5.1 정재파비 측정 조건

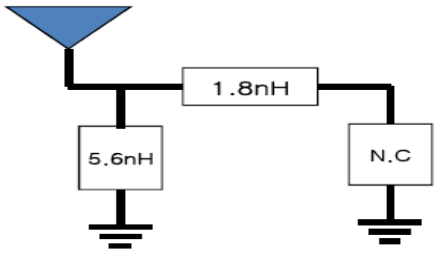
측정방법 : 그림 5-1과 같이 장비를 연결하고 NETWORK ANALYZER의 REFLECTION POINT에 안테나가 장착된 시료를 연결하여 사용주파수 대역 내에서의 IMPEDANCE를 측정한다.



(그림 5-1)

5.2 정재파비

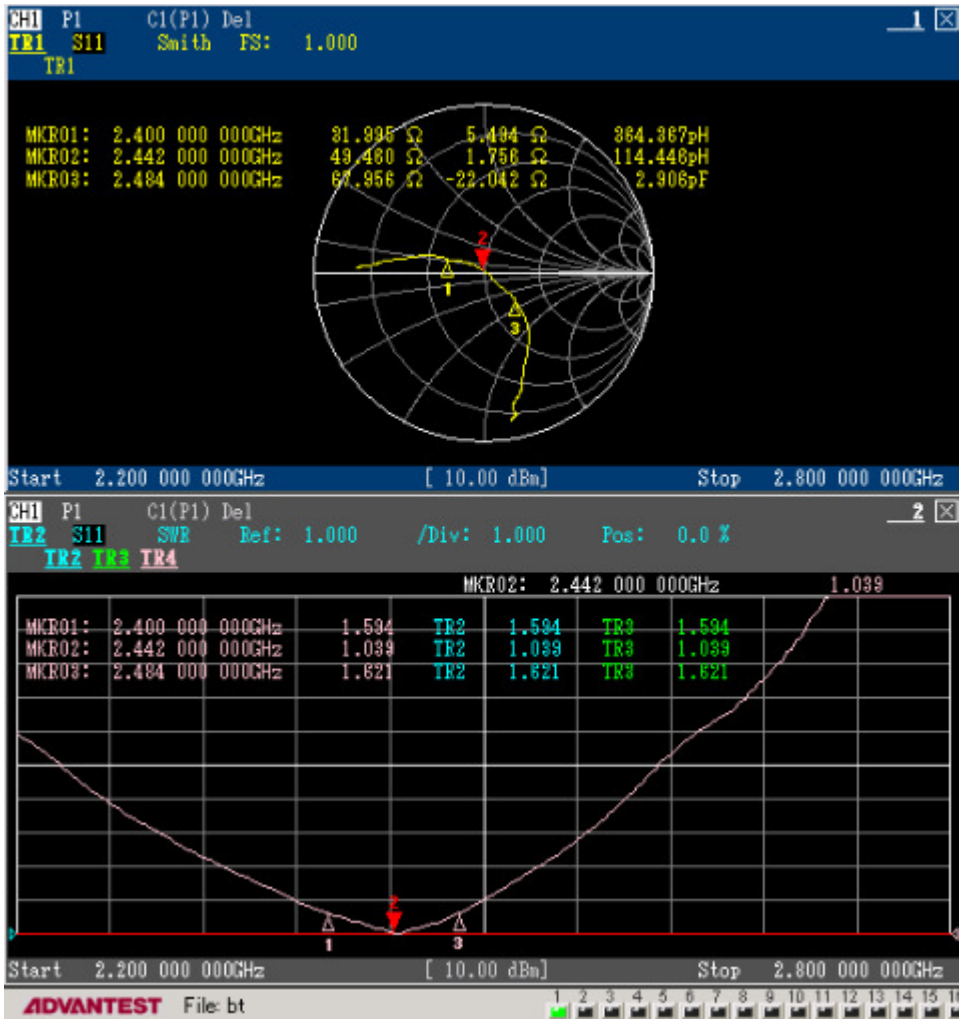
5.2.1 매칭회로



<Antenna Matching>

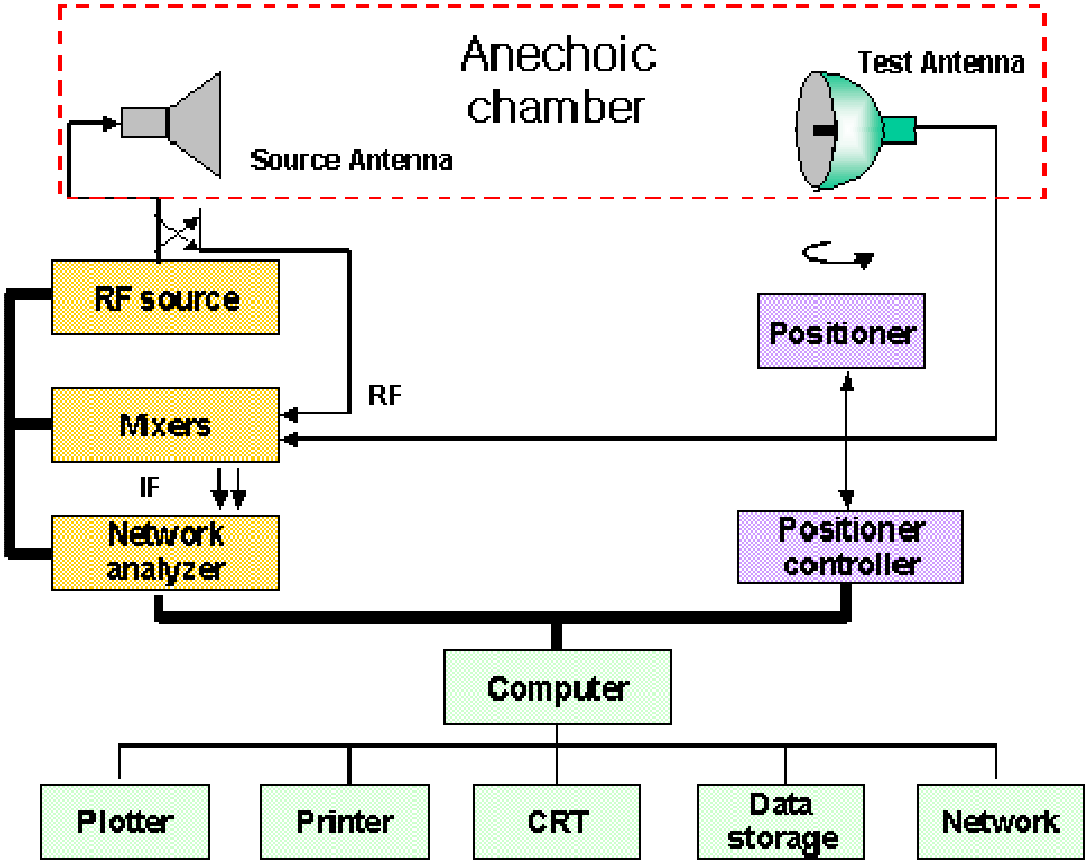
5.2.2 Network data

안테나 승인원		DATE	2012. 05. 08	REV.	1.0
MODEL	UPPER	TYPE	BLUETOOTH CHIP	9/24	9/23



5.3 안테나 이득 측정 조건

측정 방법 : 그림 5-2와 같이 혼 안테나를 표준 안테나로 설정하여 [dBi]로 나타내었다.



(그림 5-2)

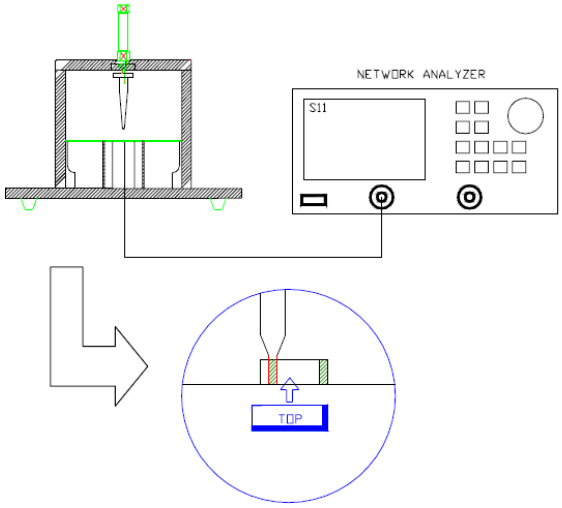
5.4 안테나 이득

5.4.1 Passive data(3D Measurement)

Frequency	Efficiency	Average Gain			Max Gain			Max Position	Directivity
		Ver	Hor	Total	Ver	Hor	Total		
2400.000000 MHz	29.3 %	-4.3 dBi	-3.9 dBi	-0.4 dBi	3.4 dBi	3.0 dBi	0.4 dBi	Theta165/Pie105	0.78 dB
2420.000000 MHz	30.5 %	-4.3 dBi	-3.7 dBi	-0.6 dBi	3.4 dBi	3.1 dBi	0.3 dBi	Theta150/Pie165	0.97 dB
2440.000000 MHz	35.5 %	-4.0 dBi	-3.5 dBi	-0.5 dBi	3.3 dBi	3.1 dBi	0.2 dBi	Theta150/Pie165	0.79 dB
2460.000000 MHz	33.1 %	-4.2 dBi	-3.6 dBi	-0.6 dBi	2.5 dBi	2.3 dBi	0.2 dBi	Theta150/Pie165	0.85 dB
2483.000000 MHz	25.9 %	-4.7 dBi	-4.1 dBi	-0.6 dBi	2.4 dBi	2.1 dBi	0.3 dBi	Theta150/Pie165	0.87 dB

5.5 수동 지그 측정 방법

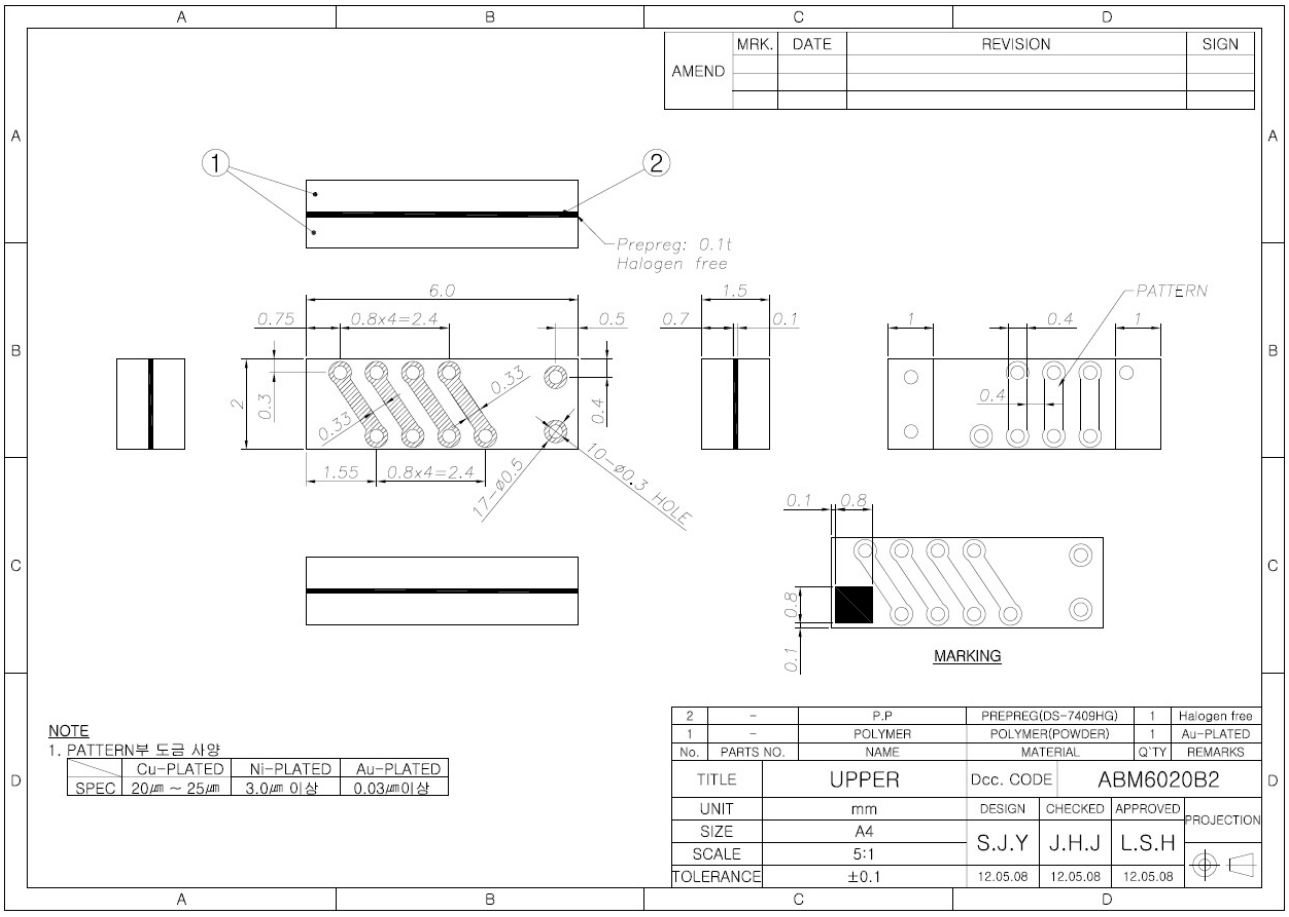
측정방법 : 그림 5-3과 같이 장비를 연결하고 NETWORK ANALYZER의 REFLECTION POINT에 특성 측정지그를 연결하여 표본 샘플을 선별,수동 측정 지그 또는 자동화 검사 장비를 이용하여 양품과 불량품을 선별한다



(그림 5-3)

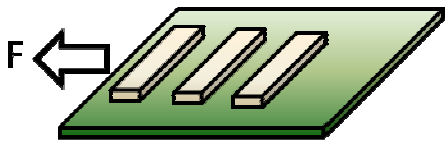
6. 기구적 요구 사항

6.1 기구적 도면

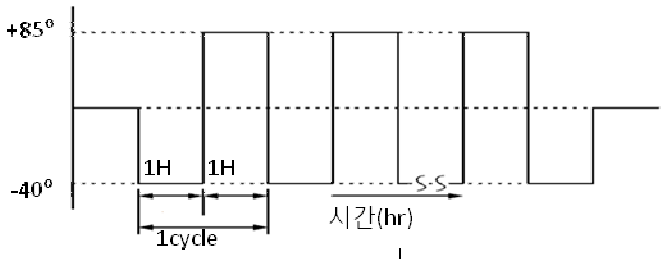


7. 신뢰성 요구 사항

7.1 기계적 실험

항목	시험방법	판정
낙하시험	▪ 조건 : 높이 150 ㎝ (10 면 = 6 면+모서리 4 개소) 1 회 실시 ▪ 셋트무게 (인테나 실장 후 시험) ▪ 바닥 : 콘크리트 또는 철판.	▪ 외관및 전기적특성 확인
도금두께	▪ 도금두께 측정기를 이용하여 하도 Ni 과 상도 Au 의 두께 측정	▪ Ni : 3 ㎛ 이상 ▪ Au : 0.03 ㎛ 이상
SMT 고착강도시험	▪SMT 완료된 제품을 F 방향으로 힘을 가하여 이탈되는 힘을 측정한다. **(시험 speed 24 min/mm)** 	▪ 5 kgf 이상

7.2 환경 시험

고습저장시험	▪ 60℃ 95%에서 48 시간 저장	▪ 외관및 전기적특성 확인
저온저장시험	▪ -40℃ 에서 48 시간 저장	▪ 외관및 전기적특성 확인
열충격시험	▪ 온도 조건 :-40±3℃/min ↔ +85±3℃/min ▪ 시험 CYCLE : 27cycle ▪ 온도 변환 시간 : 5min 미만일 것. 	▪ 외관및 전기적특성 확인
염수분무시험	▪ 5% 염수, 35℃에서 48hr 방치후 외관 , 전기적특성 확인	▪ 외관및 전기적특성 확인

8. 칩 안테나 제조 공정도

제정일자	개정No	Page No	폴리머 칩 안테나 제조 공정도	관리No	작성부서	작성	검토	승인
2012.05.08		1/1		ARQC-120508	품질관리	L.J.S		C.B.H
MODEL	UPPER							

공정구분	투입재료 부품	FLOW CHART			공정명	관련표준	요인관리				특성관리				관련 불량	관리 담당
	재료 부품명	재료 부품	생산 공정	QC 검사			설비 치공구	관리 항목	관리 빈도	기록 방법	검사 항목	계측기	검사 빈도	기록 방법		
사내 공정	폴리머 원료	▽		◇	수입검사	-					수량 무게	육안 저울	每LOT SPL'	-		검사원
			○		배치 (1차,2차)	작업지도서	교반기 탈포기 외				외관 교반상태	육안	전수	작업일지	조립 외관	작업자
			○		캐스팅 * CTQ (시트두께)	작업지도서	캐스팅 장비	두께 시트두께: 55±2㎛	每로트	작업 일지	외관 시트두께	육안 마이크로미터	每LOT SPL'	작업일지	외관 시트두께	작업자
외주 공정	폴리머 시트	▽		◇	입고검사	-		시트두께: 55±2㎛			외관 두께	육안 h/g	每LOT SPL'	-	외관 두께	검사자
			○		적층	작업지도서	적층장비	적층온도 210℃ , 3hr	每로트	작업 일지	외관 두께	육안 h/g	每LOT SPL'	작업일지	외관 두께	작업자
			○		post baking	작업지도서	적층장비	온도 180℃ , 1hr	每로트		외관	육안	每LOT		외관 수축	작업자
			○		CNC드릴	작업지도서	CNC머신	홀 내경: 300㎛ 12만RPM			홀내경	확대경	每LOT		이물불량	작업자
				◇	CNC 검사	검사기준서	현미경	홀 내경: 300㎛ 드릴 상태			홀내경 외관 이물	확대경	每LOT	검사파일	이물불량 치수불량	검사자

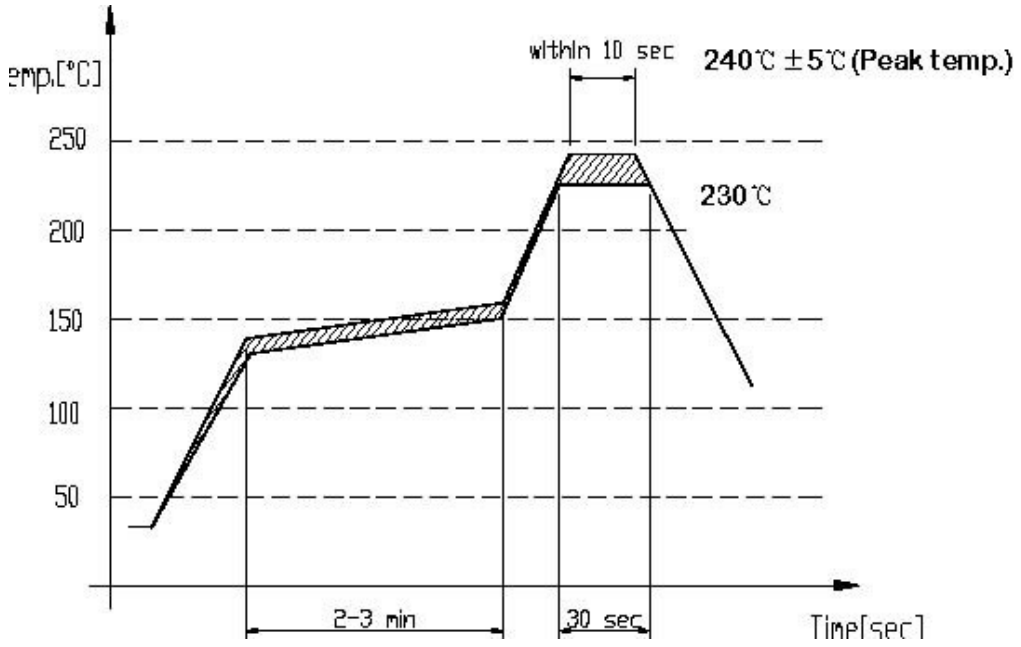
공정 구분	투입재료 부품	FLOW CHART			공정명	관련표준	요인관리				특성관리				관련 불량	관리 담당
	재료 부품명	재료 부품	생산 공정	QC 검사			설비 치공구	관리 항목	관리 빈도	기록 방법	검사 항목	계측기	검사 빈도	기록 방법		
외주 공정					플라즈마	작업지도서	플라즈마 장비	70℃ , 15min		작업 일지	외관	육안	每LOT SPL'	작업일지		작업자
					무전해 동도금	작업지도서	도금장비	clean 65℃ 화학동 40℃		작업 일지	외관	육안	每LOT	작업일지	도금	작업자
					D/F 전해동도금 에칭	작업지도서	도금장비	도금두께: 55~60㎛		작업 일지	외관	육안	每LOT	작업일지	도금	작업자
					PSR	작업지도서	인쇄기	경화온도 130℃ 시간 15분		작업 일지	외관	육안	每LOT	작업일지	균열	작업자
					금도금	작업지도서	도금장비	도금온도 80℃ Ni : 3㎛ 이상 Ai :0.03㎛이상		작업 일지	외관 두께	육안 도금두께 측정기	每LOT		이물 광택 두께	작업자
					검사	검사기준서	-	Ni : 3㎛ 이상 Ai :0.03㎛이상			외관 두께	육안 도금두께 측정기	每LOT		이물 광택 두께	검사자
					BBT 검사	-	검사장비	회로 연결상태		작업 일지	도통상태 외관	-	每LOT		단선불량	검사자
	진공포장팩				포장	작업지도서	진공포장기	포장상태	每로트	-	수량 포장상태	육안	每LOT		수량오류 포장불량	작업자
			아로납품													

공정 구분	투입재료 부품	FLOW CHART			공정명	관련표준	요인관리				특성관리				관련 불량	관리 담당
	재료 부품명	재료 부품	생산 공정	QC 검사			설비 치공구	관리 항목	관리 빈도	기록 방법	검사 항목	계측기	검사 빈도	기록 방법		
사내 공정	적층 완료품				수입검사 * CTQ (적층두께)	작업지도서	확대경 버니어캘리퍼스	두께	每로트	작업 일지	외관 두께	육안 버니어캘리퍼스	每LOT SPL'	검사파일	외관 적층두께	검사원
							적층두께: 1.40~1.60 mm									
					다이싱	작업지도서	다이싱saw	치수	每로트	작업 일지	외관 치수	육안 버니어캘리퍼스	每LOT SPL'	작업일지	외관 치수	작업자
					공정검사 * CTQ (VSWR)	검사기준서	VNA 특성검사 JIG	VNA CAL상태	每로트	작업 일지	VSWR	VNA	전수	검사파일	특성	검사자
	물품명세표 진공포장팩				출하검사	검사기준서					외관 도금상태 치수 특성	육안 V/C VNA	SPL'	출하검사 성적서	외관 치수 특성	검사원
					포장	작업지도서	진공포장기	진공팩 장갑 및 실내화 착용								
			출하													

9. 납땜 조건(Pb Free)

1) 안테나의 특성 저하를 막기 위해 다음과 같은 납땜 조건을 지켜야 한다.
   - Reflow soldering 조건으로 납땜을 진행하여야 하며, Flow soldering을 하여서는 안 된다.
   - 비활성 Flux 를 사용하여야 한다.(최대 Cl 함량 0.2% 미만)
   - Reflow cycle 횟수는 3 회 이내로 해야 한다.

Solder paste : Ag/Sn/Cu:96.5/3.0/0.5



(그림 9-1)

10. 주의 사항

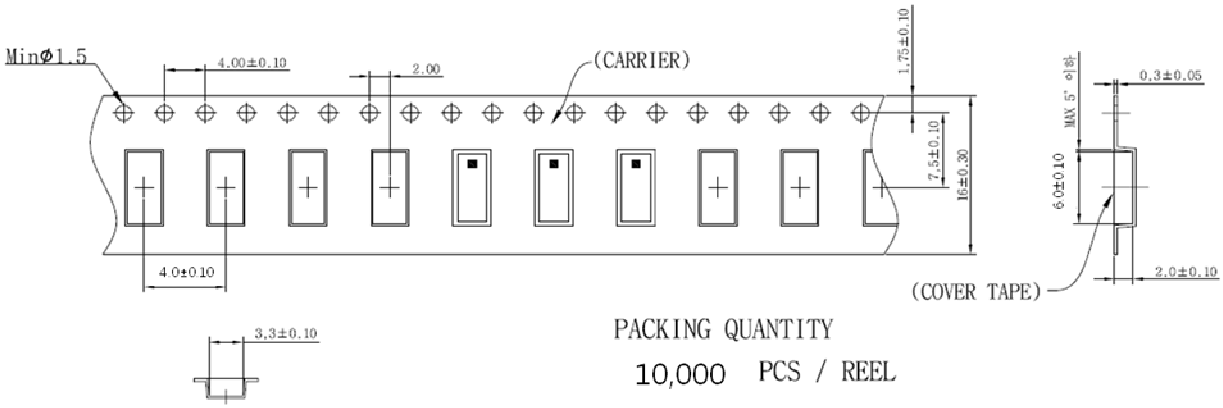
1) 보관환경은 -5 ~ 40℃, 상대습도 70% 이내의 대기에서 보관되어야 한다. (MSL Level 1)
2) Dielectric Chip Antenna는 고온/고습에서 사용하거나 또는 황이나 염소가스에 노출될 경우 전극의 납땜성 저하를 일으킬 수 있다.
3) Dielectric Chip Antenna 자체 무게에 의한 재질의 crack을 막기 위해 기계적 충격(낙하 등)을 피해야 한다.
4) Dielectric Chip Antenna는 6개월 이내에 사용되어져야 하며 6개월이 경과한 칩은 사용하기 전에 반드시 납땜성을 확인하여야 한다.
5) 안테나를 수동으로 납땜 시, 인두기의 온도를 360도 이하로 설정하고, 안테나와 직접 닿지 말아야 하며, 10초 이상 열을 가하지 말아야 한다.

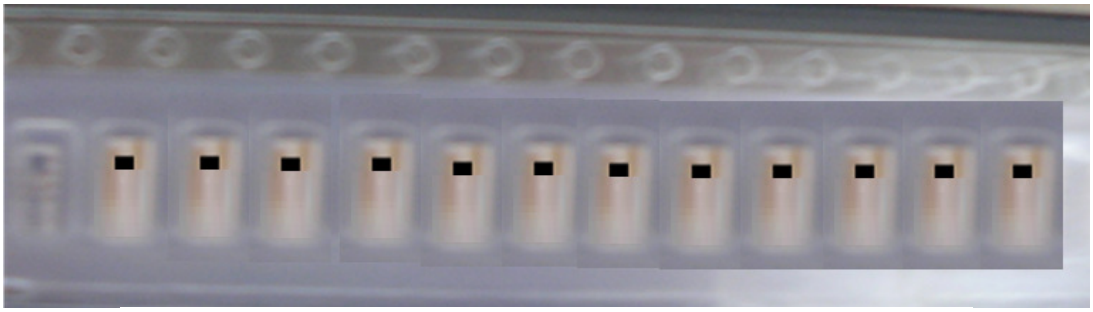
※ 수리 시 납땜 온도는 360°C 이하로 관리요망.

11. 포장 사양

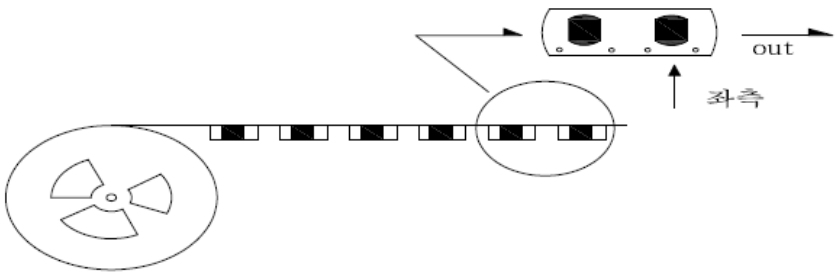
11.1 CARRIER 및 REEL 사양

1) CARRIER 사양



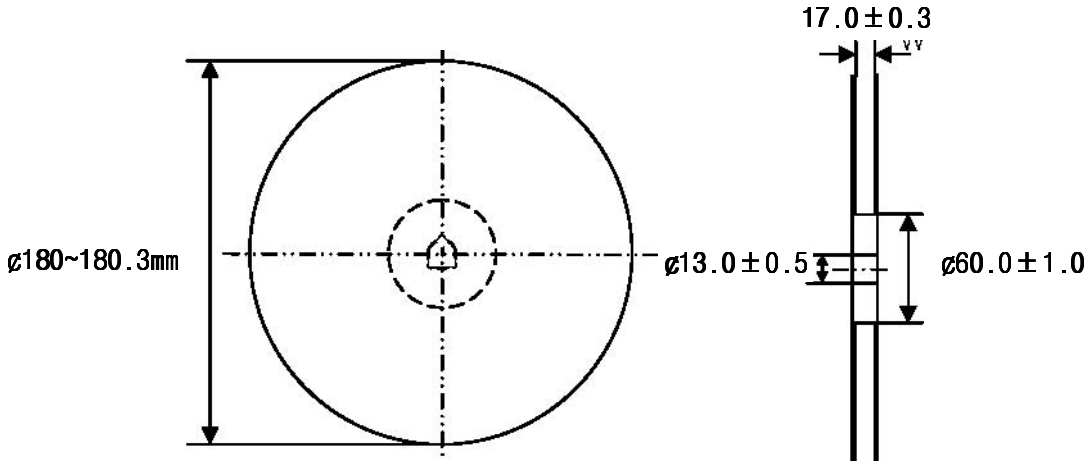


TAPING STYLE



(그림 11-1)

2) REEL 사양

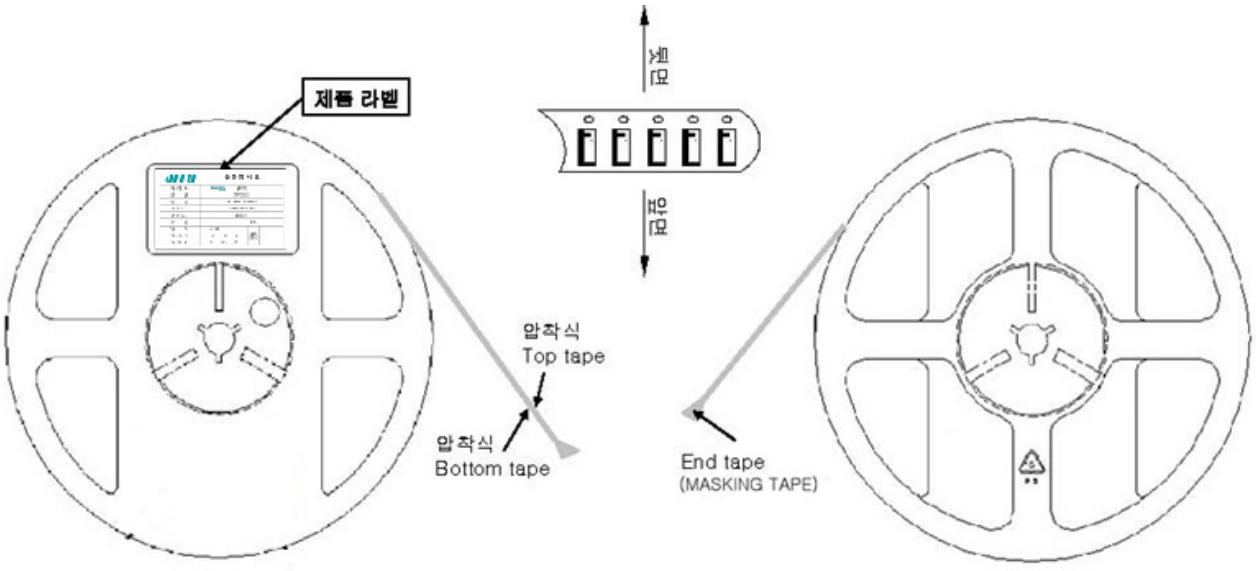


(그림 11-2)

3) 재질 및 표면 저항

품 명	재 질	표면저항
CARRIER	A-PET	10^9 ~ 10^{11} Ω
COVER TAPE	PET	10^8 ~ 10^{11} Ω
REEL	GPPS (General Purpose Poly Styrene) resin.	10^9 ~ 10^{11} Ω

1) 라벨 부착 및 Winding 방법



(그림 11-3)

11.2 박스 포장 사양

1) 진공 포장 사양 라벨 종류 및 내용

※ REEL 포장후 명세표를 부착후 (그림 11-4)와 같이 진공 포장을 한다.

[1REEL 에 10,000 pcs 포장]

(그림 11-4)

※ 포장작업 시 현품 표와 제품 및 수량을 필히 확인 한다.

2) 박스 포장 및 라벨 부착 방법

- 진공 포장된 제품을 BOX (340* 340 * 52)에 2개를 넣은 후, 그림 11-5와 같이 라벨을 부착한다. (1BOX = 2REEL = 20,000EA)

(그림 11-5)

취급 주의 사항

본 제품 취급 시 외부충격(낙하, 과부하 적재 등)이 있을 경우 제품에 이상이 발생할 수 있으니 취급 주의 할 것.

Test Report No. F690501/LF-CTSAYN11-001735

Issued Date: 2011. 02. 11

To: **LS MTRON LTD.**
938-1, Jeongeup 3 Industrial Complex
Taegok-ri, Buk-myeon
Jeongeup-city
JEONBUK
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	:	AYAA11-04593
Product Name	:	Copper Foil
Item No./Part No.	:	UCF-STN
Received Date	:	2011. 02. 09
Test Period	:	2011. 02. 10 to 2011. 02. 11
Test Results	:	For further details, please refer to following page(s)
Test Performed	:	SGS Testing Korea tested the sample(s) selected by applicant with following results.

SGS Testing Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Sample No. : 001

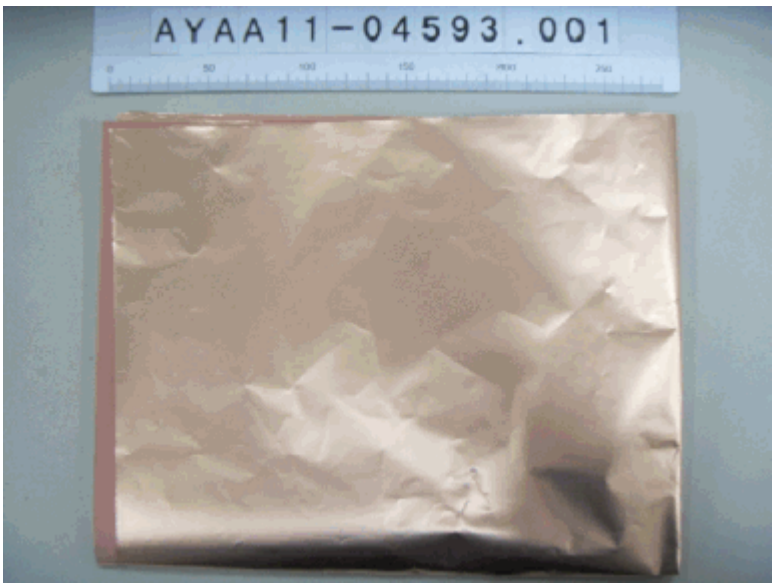
Sample Description : Copper Foil

Item No./Part No. : UCF-STN

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Fluorine(F)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Iodine(I)	mg/kg	BS EN 14582:2007 , IC	50	N.D.

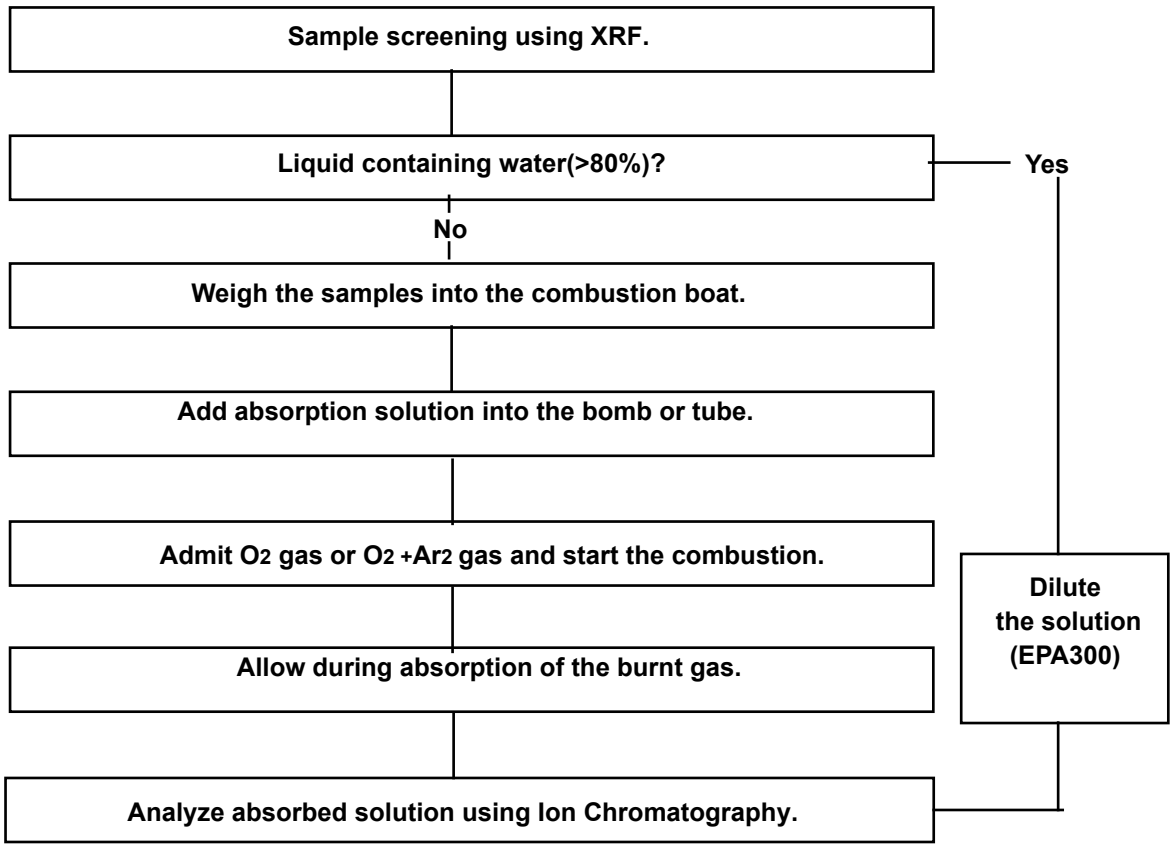
Picture of Sample as Received:



NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Flow Chart for Halogen Test



*** End ***

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

according to Regulation (EC) No. 1907/2006 REGULATION (EC) No 1272/2008

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

EC-No. 235-044-1
Product Name 218 Strontium Titanate 50 Lb Pail
Product Code: 1014629
CAS-No 12060-59-2

Relevant identified uses of the substance or mixture and uses advised against

Recommended Use For use in industrial installations only

Uses advised against Toys and food contact

Details of the supplier of the safety data sheet

Supplier
Ferro Corporation
Electronic Material System
1789 Transelco Drive
Penn Yan, NY 14441 USA

For further information, please contact

E-mail address c-palkog@ferro.com

Emergency telephone number

Chemtrec: 1-800-424-9300 for US/ 703-527-3887 outside US

Emergency telephone §45 - (EC)1272/2008

2. HAZARDS IDENTIFICATION

Classification of the substance or mixture

REGULATION (EC) No 1272/2008

Not classified

Classification according to EU Directives 67/548/EEC or 1999/45/EC

For the full text of the R-phrases mentioned in this Section, see Section 16

Symbol(s)

Not dangerous goods

Label Elements

Not classified

Other Hazards

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	EC-No.	CAS Number	Weight %	Classification 67/548/EC	CLP Classification	REACH No.
Strontium Titanate	235-044-1	12060-59-2	100			

For the full text of the R-phrases mentioned in this Section, see Section 16

4. FIRST AID MEASURES

Description of first-aid measures

Eye contact: Rinse immediately with plenty of water, also under the eyelids Get medical attention if irritation develops

Skin contact: Wash off immediately with soap and plenty of water Remove and wash contaminated clothing before re-use If symptoms persist, call a physician

Ingestion: Drink plenty of water. Do not induce vomiting without medical advice. Consult a physician if necessary.

Inhalation Move to fresh air in case of accidental inhalation of vapors or decomposition products

Most important symptoms and effects, both acute and delayed

No information available.

Indication of immediate medical attention and special treatment needed

Protection of first-aiders: Treat symptomatically

5. FIRE-FIGHTING MEASURES

Extinguishing media

Suitable extinguishing media: Use extinguishing measures that are appropriate to local circumstances and the surrounding environment

Extinguishing media which must not be used for safety reasons: No information available.

Special hazards arising from the substance or mixture

Special exposure hazards arising from the substance or preparation itself, combustion products, resulting gases None in particular.

Advice for emergency responders

Special protective equipment for fire-fighters As in any fire, wear self-contained breathing apparatus and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions: Avoid dust formation Avoid contact with skin, eyes and clothing Use personal protective equipment Evacuate area of all unnecessary personnel

Other information See Section 8 for additional information

Environmental precautions

Prevent further leakage or spillage if safe to do so Do not let product enter drains Do not flush into surface water or sanitary sewer system

Methods and materials for containment and cleaning up

Sweep up and shovel into suitable containers for disposal. Clean contaminated surface thoroughly. Dispose of promptly.

Reference to other sections

See Section 13 for additional information.

7. HANDLING AND STORAGE

Precautions for Safe Handling

Handling: Handle in accordance with good industrial hygiene and safety practice

Hygiene measures Safety glasses

Conditions for safe storage, including any incompatibilities

No information available.

Specific End Uses

Exposure Scenario No information available
Other Guidelines No information available

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

Exposure Limits This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Derivation of DNEL(s) No information available
Derivation of the PNEC No information available.

Exposure controls

Engineering measures: Provide appropriate exhaust ventilation at machinery and at places where dust or fumes can be generated Ensure that eyewash stations and safety showers are proximal to the work-station location

Personal protective equipment

Eye Protection: Safety glasses with side-shields.
Hand protection: Impervious gloves
Skin and body protection: Lightweight protective clothing
Respiratory protection: Use NIOSH approved respirator when ventilation is inadequate
Hygiene measures No information available

Environmental Exposure Controls No information available

9. PHYSICAL AND CHEMICAL PROPERTIES

General Information

Physical state Powder
Color: White
Odor: Odorless

Important health safety and environmental information

Flash Point Not combustible.
Flammability (solid, gas): No information available
Boiling point/boiling range No information available.
pH No information available
Vapor pressure : No data available
Viscosity 22 mm^2 s-1
Water solubility: Insoluble
Specific gravity (Water =1): 4.600
Oxidizing properties No information available
Evaporation Rate (Water = 1) No information available
Relative density : No information available
Vapor density: No information available
Explosive properties: No information available

Other information

Refractive index: No data available
Surface tension: No data available

10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical Stability
Stable under normal conditions.

Possibility of Hazardous Reactions
Hazardous Polymerization None under normal processing.

Conditions to Avoid
Do not freeze

Incompatible materials
To avoid thermal decomposition, do not overheat

Hazardous Decomposition Products
None under normal processing

11. TOXICOLOGICAL INFORMATION

Information on toxicological effects

Acute Toxicity

Product information	Product does not present an acute toxicity hazard based on known or supplied information.
Inhalation	May cause irritation of respiratory tract.
Eye Contact	May cause irritation.
Skin Contact	Substance may cause slight skin irritation.
Ingestion	May cause irritation

Irritation	No information available.
Corrosivity	No information available.
Sensitization	No information available
Mutagenic Effects:	No information available
Carcinogenic Effects	No information available.
Reproductive Toxicity	No information available
Developmental Toxicity	No information available
STOT - single exposure	No information available
STOT-repeated exposure	No information available
Aspiration Hazard	No information available
Endocrine Disruptor Information	This product does not contain any known or suspected endocrine disruptors

12. ECOLOGICAL INFORMATION

Toxicity
Ecotoxicity Effects
Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants.

Persistence and degradability
No information available
Bioaccumulative potential
No information available
Mobility in soil
No information available
Results of PBT and vPvB assessment
Not classified
Other adverse effects
Endocrine Disruptor Information
This product does not contain any known or suspected endocrine disruptors

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from Residues/Unused Products Dispose of in accordance with local regulations.

Contaminated Packaging Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. TRANSPORT INFORMATION

IMDG/IMO Not regulated

RID not regulated

Adr: Not regulated

IATA-DGR not regulated

IATA not regulated

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

International Inventories

TSCA 8(b):	Listed or exempt.
EC-No.	Listed or exempt.
Canadian DSL/NDSL list	All ingredient(s) are listed on the DSL or NDSL
Philippines (PICCS):	Listed.
Japan (ENCS):	Listed or exempt.
China (IECS):	Listed.
Australia (AICS):	Listed.
Korea (KECL):	Listed.

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
PICCS - Philippines Inventory of Chemicals and Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
AICS - Australian Inventory of Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances

Chemical Safety Assessment

16. OTHER INFORMATION

List of relevant R-phrases
No information available

16. OTHER INFORMATION

Key literature references and sources for data
www.ChemADVISOR.com

Prepared by: Ferro Technical Center
Revision Note A component has been added to the formulation. SEE SECTION 2.
Disclaimer: The information and recommendations contained in this Material Safety Data Sheet have been compiled from sources believed to be reliable and to represent the most reasonable current opinion on the subject when the MSDS was prepared. No warranty, guaranty or representation is made as to the correctness or sufficiency of the information. The user of this product must decide what safety measures are necessary to safely use this product, either alone or in combination with other products, and determine its environmental regulatory compliance obligations under any applicable federal or state laws.

End of Safety Data Sheet

Test Report No. F690501/LF-CTSAYAA11-23009

To: **HEESUNG METAL CO., LTD.**
#548-1
Gajwa-dong
Seo-gu
Incheon 404-250
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA11-23009
Product Name	: KAu(CN)2
Item No./Part No.	: N/A
Received Date	: 2011. 07. 12
Test Period	: 2011. 07. 13 to 2011. 07. 18
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results.

SGS Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Sample No. : AYAA11-23009.001

Sample Description : KAu(CN)2

Item No./Part No. : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.
Antimony (Sb)	mg/kg	With reference to EPA 3052(1996), US EPA 6010B(1996), ICP	10	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Sample No. : AYAA11-23009.001

Sample Description : KAu(CN)2

Item No./Part No. : N/A

Inorganic Contents

Test Items	Unit	Test Method	MDL	Results
Bromide (Br-)	mg/L	US EPA300.0, IC	30	N.D.
Chloride (Cl-)	mg/L	US EPA300.0, IC	30	N.D.

Other(s)

Test Items	Unit	Test Method	MDL	Results
PFOA(Perfluorooctanioc acid)	mg/kg	US EPA 3540C/3550C, LC/MS	1	N.D.
PFOS(Perfluorooctane Sulfonates-Acid/Metal Salt/Amide)	mg/kg	US EPA 3540C/3550C, LC/MS	1	N.D.

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
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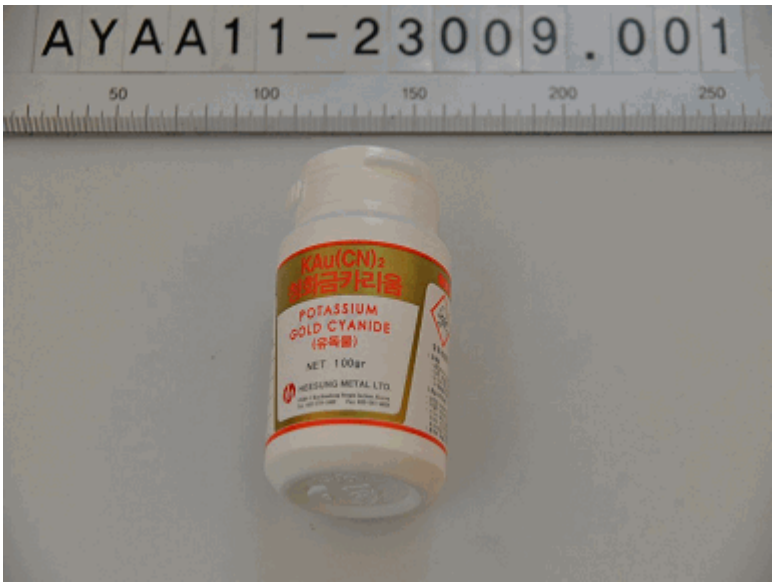
Picture of Sample as Received:



NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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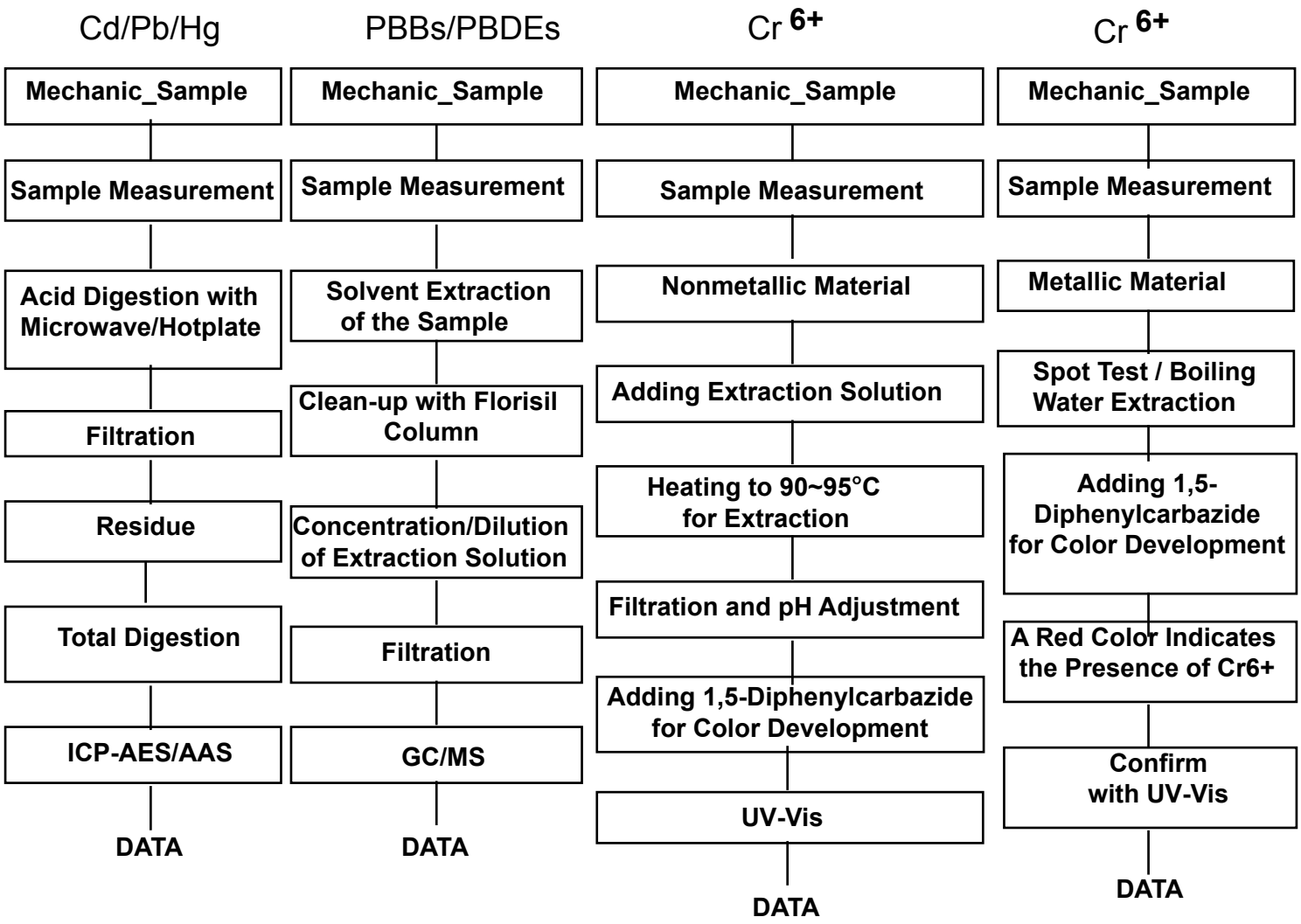
Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+}/PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Section Chief : Gilsae Yi

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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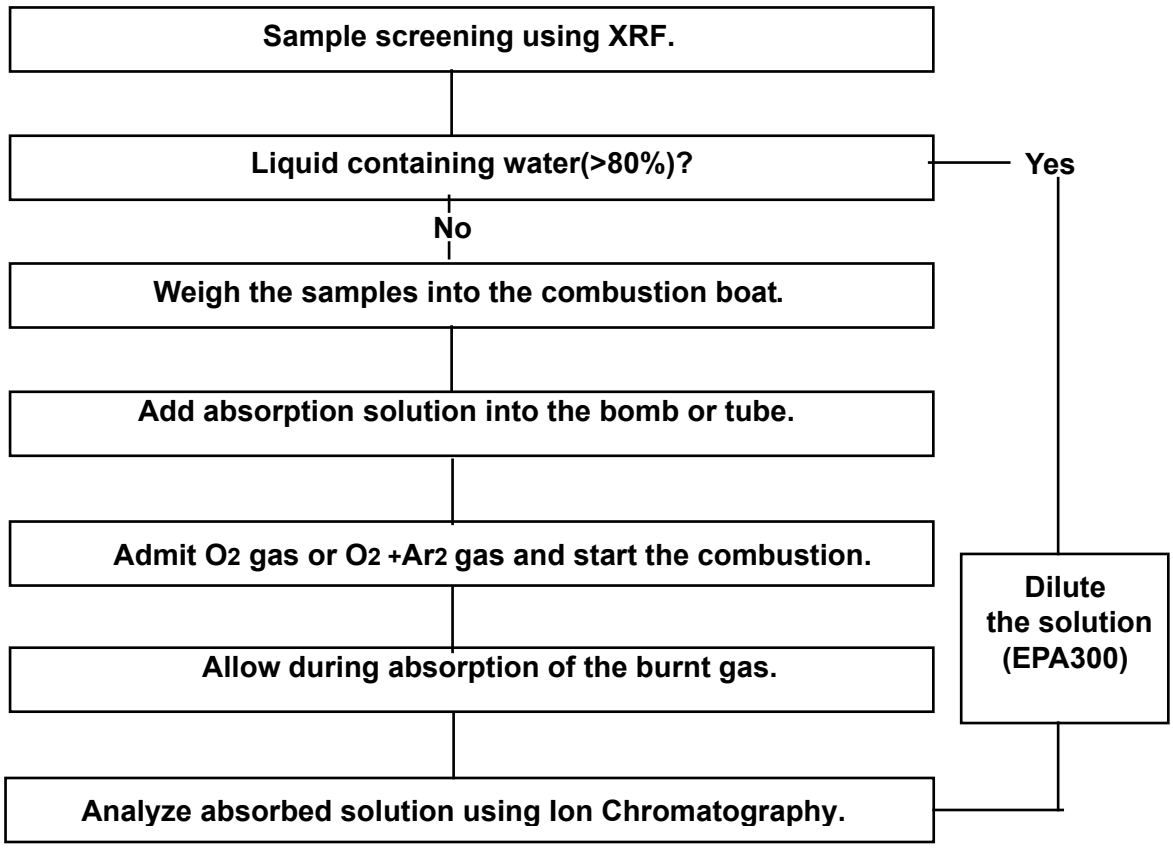
Flow Chart for Halogen Test



*** End ***

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
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Test Report No. F690101/LF-CTSAYAA12-18573

To: **ARRO CO., LTD.**
205-11, Anyang-dong,
Manan-gu,
Anyang-city
Gyeonggi-do
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA12-18573
Product Name	: Strontume Titanate(SrTiO3)
Item No./Part No.	: N/A
Received Date	: 2012. 05. 09
Test Period	: 2012. 05. 10 to 2012. 05. 14
Buyer(s)	: LG
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results.

SGS Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

Sample No. : AYAA12-18573.001
Sample Description : Strontume Titanate(SrTiO3)
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

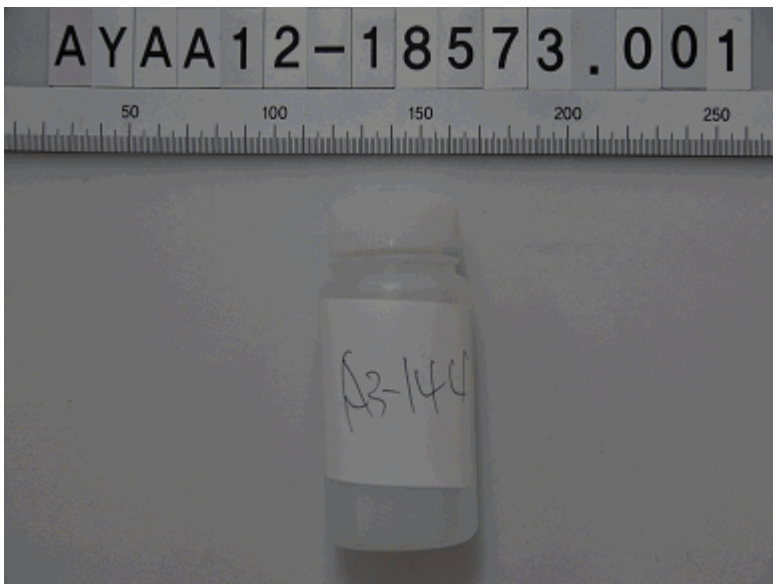
NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

Sample No. : AYAA12-18573.001
Sample Description : Strontume Titanate(SrTiO3)
Item No./Part No. : N/A
Materials : N/A

Halogen Contents

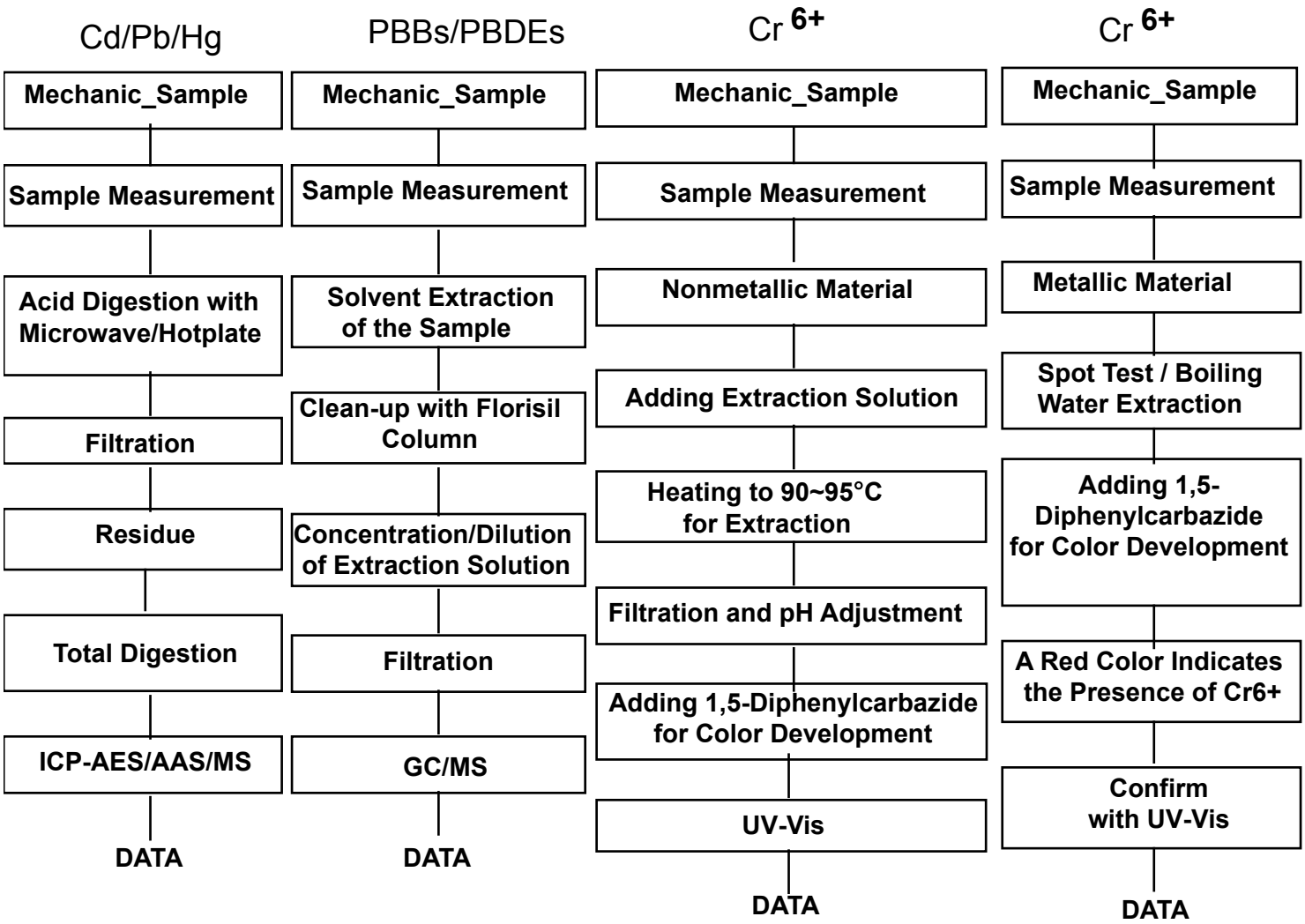
Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007 , IC	30	N.D.

Picture of Sample as Received:



NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

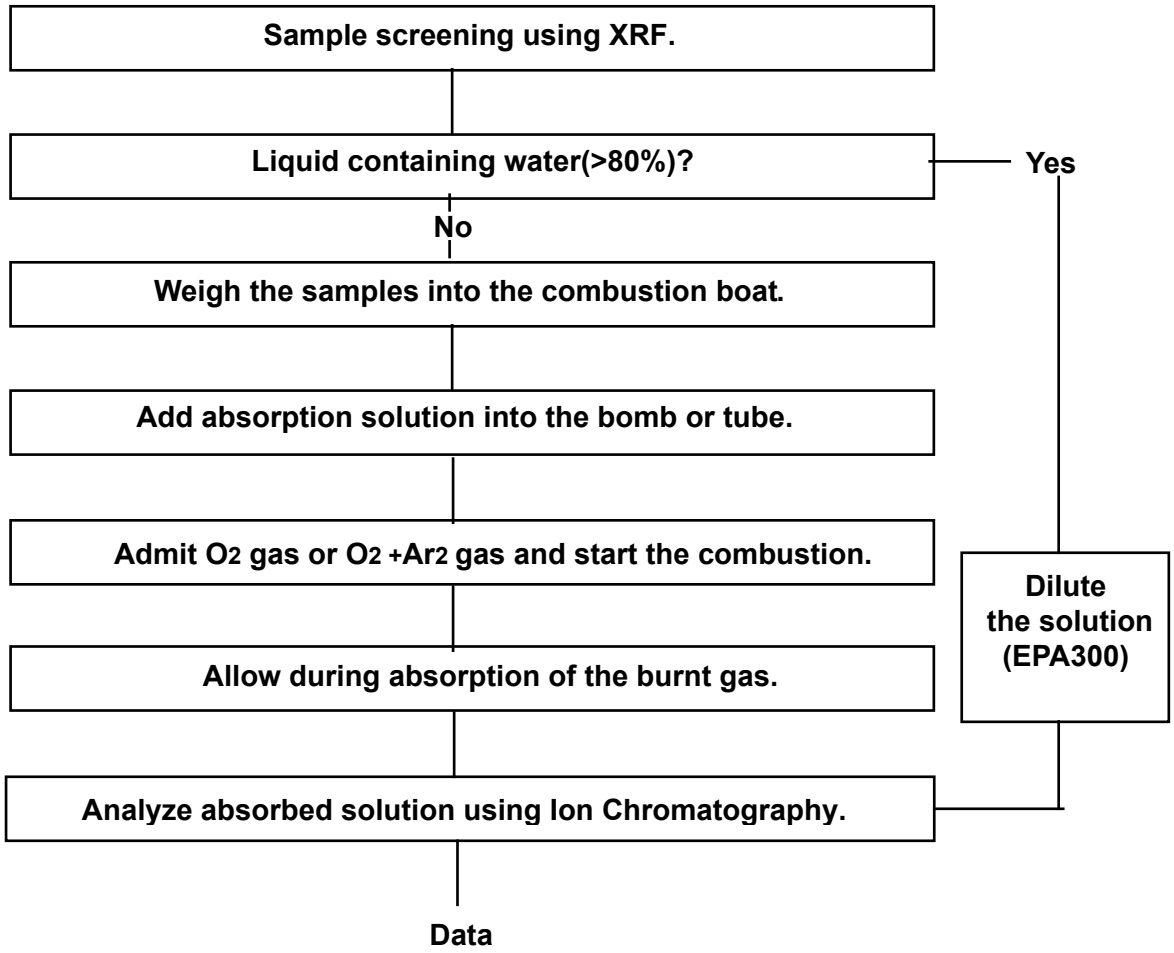
Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+} /PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

Flow Chart for Halogen Test



*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) Negative = Undetectable / Positive = Detectable
(6) ** = Qualitative analysis (No Unit)
(7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

TEST REPORT

Applicant : Doosan Corporation Electro-Materials BG

Address : 5th Floor, Doosan Technical Center Bldg. 39-3 Sungbok-dong, Suji-gu, Yongin-si, Kyungki-do, Korea

Report No. RT11R-S4159-009-E3 Date: Nov. 02, 2011

Sample Description	: The following submitted sample(s) said to be:-
Name/Type of Product	: DS-7409HG BS
Sample ID No.	: RT11R-S4159-009
Manufacturer/Vender	: Doosan Corporation Electro-Materials BG
Sample received	: Oct. 27, 2011
Testing Date	: Oct. 27, 2011 ~ Nov. 02, 2011
Testing Environment	: Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.
Test Method(s)	: Please see the following page(s).
Test Result(s)	: Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.

* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

Intertek Testing Services Korea Ltd.

Seoul Office: Tel : 02-6090-9500 Fax : 02-3409-0026 Daegu Office : Tel : 053-600-8647 Fax : 053-600-8645 Web Site : www.Intertek.co.kr
Seoul Lab. Address : 1/F, A-ju Digital Tower, #284-56, Seongsu 2-ga, Seongdong-Gu, Seoul, 133-833 Korea
Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Report No. RT11R-S4159-009-E3 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Test Item	Unit	Test Method	MDL	Result
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	99

Tested by : Nikkie Lee

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received;-

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Seoul Office: Tel : 02-6090-9500 Fax : 02-3409-0026 Daegu Office : Tel : 053-600-8647 Fax : 053-600-8645 Web Site : www.Intertek.co.kr
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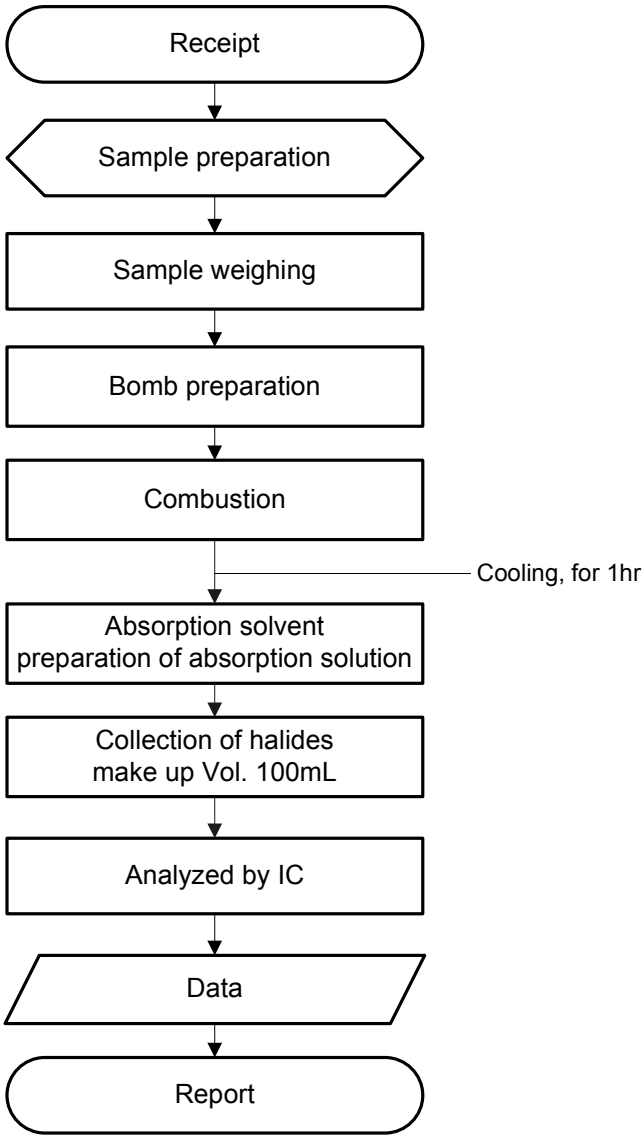
Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Flow Chart (Halogen)



***** End of Report *****

Intertek Testing Services Korea Ltd.

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Applicant : Doosan Corporation Electro-Materials BG

Address : 5th Floor, Doosan Technical Center Bldg. 39-3 Sungbok-dong, Suji-gu, Yongin-si, Kyungki-do, Korea

Report No. RT11R-S4159-009-E7 Date: Nov. 02, 2011

Sample Description	: The following submitted sample(s) said to be:-
Name/Type of Product	: DS-7409HG BS
Sample ID No.	: RT11R-S4159-009
Manufacturer/Vender	: Doosan Corporation Electro-Materials BG
Sample received	: Oct. 27, 2011
Testing Date	: Oct. 27, 2011 ~ Nov. 02, 2011
Testing Environment	: Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.
Test Method(s)	: Please see the following page(s).
Test Result(s)	: Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.

* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

Intertek Testing Services Korea Ltd.

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Report No. RT11R-S4159-009-E7 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Test Item	Unit	Test Method	MDL	Result
Phthalates				
Dibutyl phthalate (DBP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Di(2-ethylhexyl) phthalate (DEHP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Di-n-octyl phthalate (DNOP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Diisononyl phthalate* (DINP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	100	N.D.
Diisodecyl phthalate** (DIDP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	100	N.D.
Benzyl butyl phthalate (BBP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Di(2-methoxyethyl) phthalate (DMEP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Di-n-hexyl phthalate (DNHP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Diethyl phthalate (DEP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Diisobutyl phthalate (DIBP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Dimethyl phthalate (DMP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.

Tested by : Ellen Jung

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* DINP include two types of phthalate (CAS No. 68515-48-0 and 28553-12-0).
** DIDP include two types of phthalate (CAS No. 68515-49-1 and 26761-40-0).

TEST REPORT

Report No. RT11R-S4159-009-E7 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

* View of sample as received;-

Intertek Testing Services Korea Ltd.

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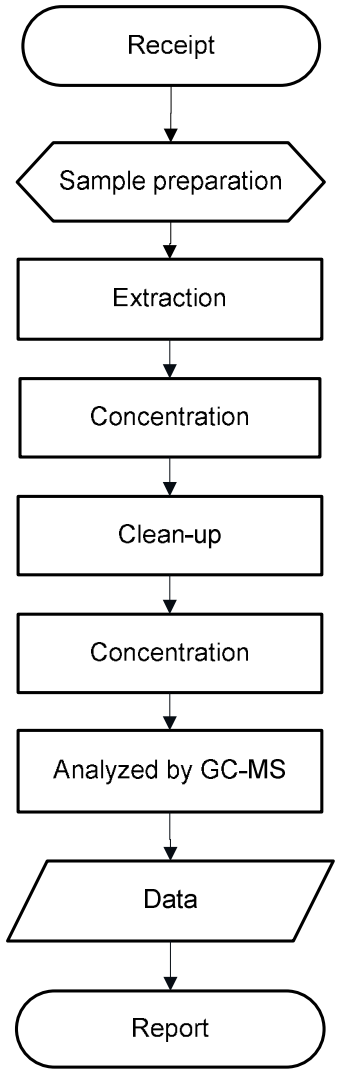
Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Report No. RT11R-S4159-009-E7 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Flow Chart (Phthalates)



***** End of Report *****

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Applicant : Doosan Corporation Electro-Materials BG

Address : 5th Floor, Doosan Technical Center Bldg. 39-3 Sungbok-dong, Suji-gu, Yongin-si, Kyungki-do, Korea

Report No. RT11R-S4159-009-E1 Date: Nov. 02, 2011

Sample Description	: The following submitted sample(s) said to be:-
Name/Type of Product	: DS-7409HG BS
Sample ID No.	: RT11R-S4159-009
Manufacturer/Vender	: Doosan Corporation Electro-Materials BG
Sample received	: Oct. 27, 2011
Testing Date	: Oct. 27, 2011 ~ Nov. 02, 2011
Testing Environment	: Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.
Test Type	: RoHS wet chemical analysis
Test Method(s)	: Please see the following page(s).
Test Result(s)	: Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.

* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

Intertek Testing Services Korea Ltd.

Seoul Office: Tel : 02-6090-9500 Fax : 02-3409-0026 Daegu Office : Tel : 053-600-8647 Fax : 053-600-8645 Web Site : www.Intertek.co.kr
Seoul Lab. Address : 1/F, A-ju Digital Tower, #284-56, Seongsu 2-ga, Seongdong-Gu, Seoul, 133-833 Korea
Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Report No. RT11R-S4159-009-E1 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Test Item	Unit	Test Method	MDL	Result
Cadmium (Cd)	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg		2	N.D.
Mercury (Hg)	mg/kg		2	N.D.
Hexavalent Chromium (Cr^{6+}) (For non-metal)	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by alkaline digestion and determined by UV-VIS Spectrophotometer	1	N.D.
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS	5	N.D.
Dibromobiphenyl	mg/kg		5	N.D.
Tribromobiphenyl	mg/kg		5	N.D.
Tetrabromobiphenyl	mg/kg		5	N.D.
Pentabromobiphenyl	mg/kg		5	N.D.
Hexabromobiphenyl	mg/kg		5	N.D.
Heptabromobiphenyl	mg/kg		5	N.D.
Octabromobiphenyl	mg/kg		5	N.D.
Nonabromobiphenyl	mg/kg		5	N.D.
Decabromobiphenyl	mg/kg		5	N.D.
Polybrominated Diphenyl Ether (PBDEs)				
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS	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	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.

Tested by : Nikkie Lee, Leo Kim, Ellen Jung, Jessica Kang

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

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TEST REPORT

Report No. RT11R-S4159-009-E1 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

* View of sample as received;-

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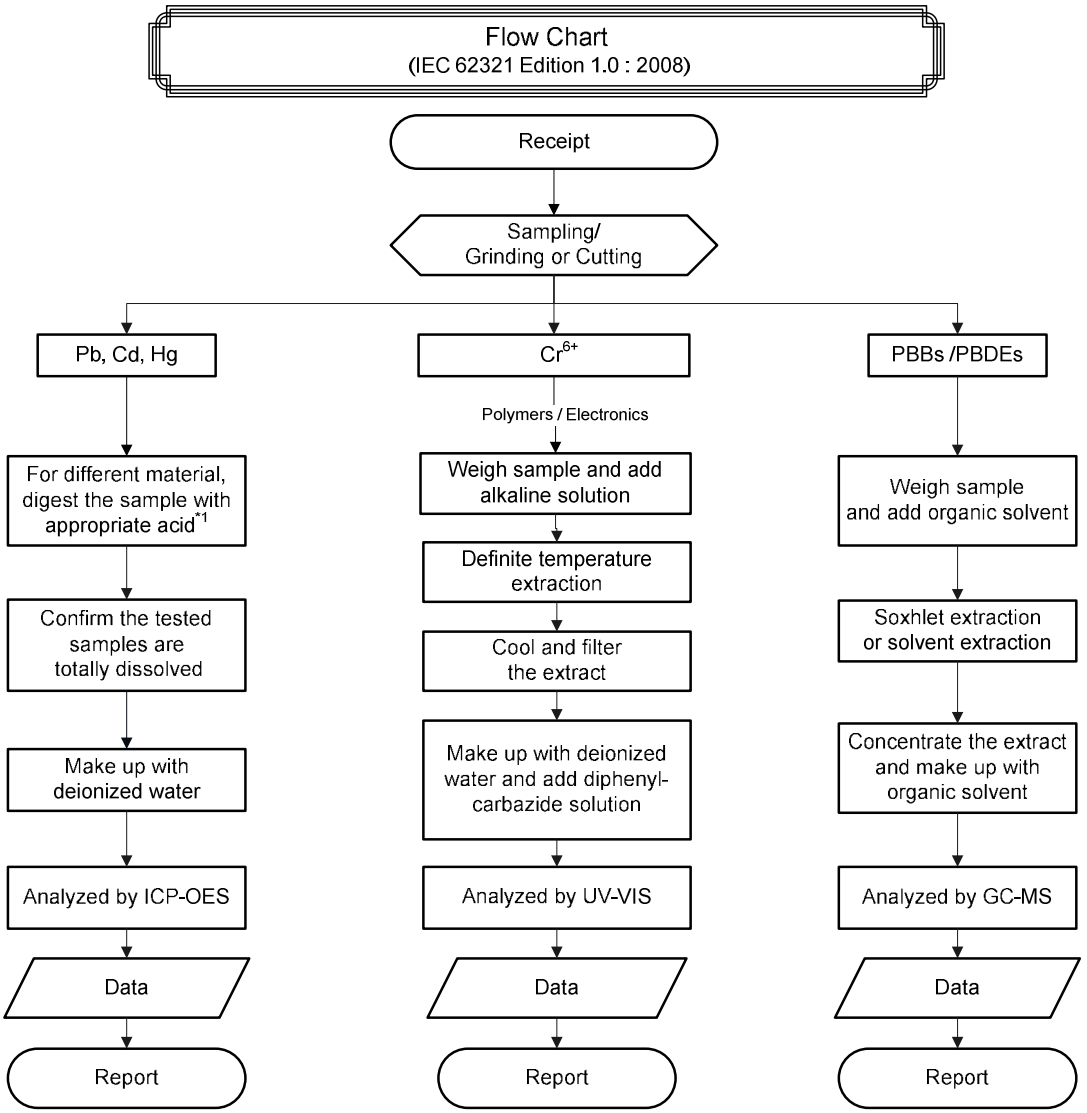
Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS



Remarks :

*1 : List of appropriate acid :

Material	Acid added for digestion
Polymers	HNO_3, HCl, HF, H_2O_2, H_3BO_3
Metals	HNO_3, HCl, HF
Electronics	HNO_3, HCl, H_2O_2, HBF_4

***** End of Report *****

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TEST REPORT

Applicant : Doosan Corporation Electro-Materials BG

Address : 5th Floor, Doosan Technical Center Bldg. 39-3 Sungbok-dong, Suji-gu, Yongin-si, Kyungki-do, Korea

Report No. RT11R-S4159-009-E4 Date: Nov. 02, 2011

Sample Description	: The following submitted sample(s) said to be:-
Name/Type of Product	: DS-7409HG BS
Sample ID No.	: RT11R-S4159-009
Manufacturer/Vender	: Doosan Corporation Electro-Materials BG
Sample received	: Oct. 27, 2011
Testing Date	: Oct. 27, 2011 ~ Nov. 02, 2011
Testing Environment	: Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.
Test Method(s)	: Please see the following page(s).
Test Result(s)	: Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.

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Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

TEST REPORT

Report No. RT11R-S4159-009-E4 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Test Item	Unit	Test Method	MDL	Result
Antimony (Sb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.

Tested by : Nikkie Lee

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received;-

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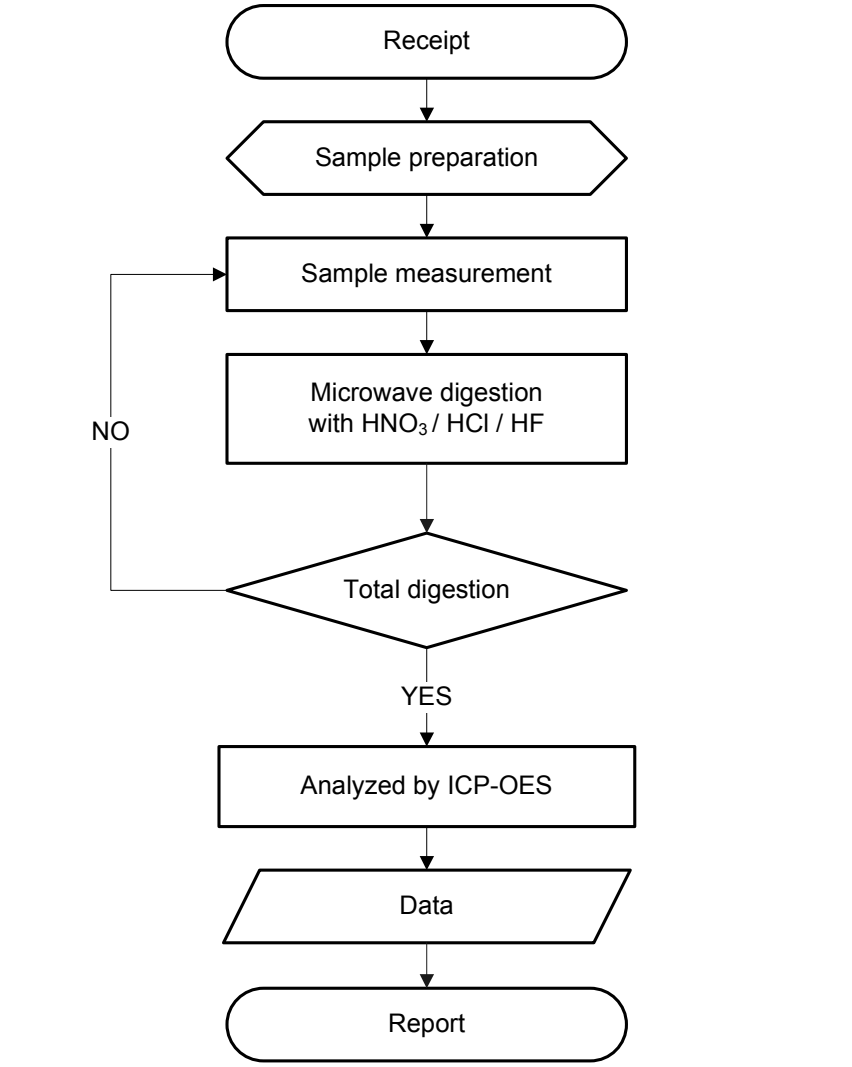
TEST REPORT

Report No. RT11R-S4159-009-E4 Date: Nov. 02, 2011

Sample ID No. : RT11R-S4159-009
Sample Description : DS-7409HG BS

Flow Chart (Metal Testing)



** Remarks : The samples were dissolved totally by pre-conditioning method according to above flow chart.

***** End of Report *****

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Doosan Corporation
Electro-Materials BG
Doosan Co. Electro-Materials BG. 39-3 Sungbok-Dong, Suji-Gu, Yongin-Si, Gyeonggi-Do, Korea

Material Safty Data Sheet

1. CHEMICAL PRODUCT AND COMPANY INDENTIFICATION

PRODUCT NAME	:	DS-7409HG BS G
OTHER/GENERIC NAMES	:	Glass Fabric Reinforced Epoxy Bonding Sheet
PRODUCTS USE	:	Industrial Thermosetting Laminate for printed circuitry
MANUFACTURER	:	Doosan corporation Electro-Materials BG 39-3 Sungbok-Dong, Suji-Gu, Yongin-Si, Gyeonggi-Do, Korea

FOR MORE INFORMATION CALL :	IN CASE OF EMERGENCY CALL:
(Monday-Friday, 8:30am-6:00pm)	(24 Hours/Day, 7days/Week)
82-31-260-6301	82-31-260-6301

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS #	WEIGHT %
Glass cloth	(65997-17-3)	15 ~ 50
Epoxy	(7328-97-4)	5 ~ 25
Flame Resistant Epoxy Resin	-	5 ~ 25
Heat Resistant Resin	-	5 ~ 25
Inorganic Filler	-	25 ~ 45

3. HAZARDS IDENTIFICATION

EMERGENCY OVER VIEW :

A nonflammable, sheet material. When machined or punched, occurring dust may cause skin or eye irritation. Fumes, smoke, and gases from thermal decomposition may irritate eyes, nose, and throat.

POTENTIAL HEALTH HAZARDS :

SKIN	:	Dust may cause moderate skin irritation
EYES	:	Dust may cause moderate eye irritation. Fumes may irritate eyes
INHALATION	:	Dust or Fumes may cause irritation of the throat
INGESTION	:	Not determined
DELAYED EFFECTS	:	None

Although the information and recommendation in this Material Safety Data Sheet(information) are presented in good faith and believed to be correct as of the data stated above, Doosan Electro-Materials co., LTD. make no representation or warranty as to the completeness or accuracy of this information.

This information is supplied with the condition that the person receiving this MSDS will make their own determination as to its suitability for their purpose prior to implementation

For additional information, please contact our Quality Assurance Department

4. FIRST AID MEASURES

SKIN	Wash dust off in flowing water or shower. Change contaminated cloth.
EYE	Irritate with flowing water for 15 minutes. If irritation persists, consult a physician.
INHALATION	If overcome by dust or smoke, remove to fresh air. If not breathing, give mouth-to-mouth resuscitation. Call physician.
INGESTION	If large amounts are ingested, consult physician.
ADVICE TO PHYSICIAN :	Treat symptomatically

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES	N/A
FLASH POINT	N/A
FLASH POINT METHOD	Not determined
AUTOIGNITION TEMPERATURE	N/A
UPPER FLAME LIMIT(Volume % in air)	N/A
LOWER FLAME LIMIT(Volume % in air)	N/A
FLAME PROPAGATION RATE(Solids)	UL V-0
OSHA FLAMMABILITY CLASS	N/A
EXTINGUISHING MEDIA	Water, CO2 and dry chemical
UNUSUAL FIRE AND EXPLOSION HAZARD :	May give off toxic gases containing CO2, CO, NOx, hydrocarbon fragments, and HCN when burned or heated to thermal decomposition

SPECIAL FIREFIGHTING PRECAUSION/INSTRUCTIONS :

Fireman should wear proper protective equipment and positive pressure self-contained breating apparatus

6. ACCIDENTAL RELEASE MEASURES

INCASE OF SPILL OR OTHER RELEASE:(Always wear recommended personal protection equipment)

Not applicable, material is an article.

Spills and releases may have to be reported to fedral and/or local authorities.

See the Regulatory Information section(#15) regarding reporting requirements

7. HANDING AND STORAGE

NORMAL HANDLING :	(Always wear recommended personal protective equipment) The primary exposure route is inhalation of dust when machined/punched and fumes or vapors when heated to thermal decomposition
STORAGE RECOMMENDATIONS :	Avoid hot, humid and water condition

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS	:	Use local exhaust ventilation to control dust.
PERSONAL PROTECTIVE EQUIPMENT :		
SKIN PROTECTION	:	For brief contact to dust, no precautions other than clean body-covering clothing should be needed. Use gloves and aprons when prolonged or frequently repeated contact occurs.
EYE PROTECTION	:	Use appropriate eye protection when machining material
RESPIRATORY PROTECTION	:	Atmospheric levels of Glass Fabric Dust should be maintained below exposure guidelines. When respiratory protection is required for certain operations, use a NIOSH-approved dust respirator.
ADDITIONAL RECOMMENDATIONS :		N/A
EXPOSURE GUIDELINES	:	(Guidelines exist for the following ingredients)

Ingredient Name	CAS. NO.	TLV-ACGIH	OSHA PEL	Other Limit
Glass cloth	(65997-17-3)	10mg/m3	None	N/A
Epoxy	(7328-97-4)	5ppm	5ppm	N/A
Flame Resistant Epoxy Resin	-	N/A	N/A	N/A
Heat Resistant Resin	-	N/A	N/A	N/A
Inorganic Filler	-	0.1mg/m3	N/A	6mg/m3

Other exposure limits for the decomposition products normally associated with product use are as follows : None

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	:	Yellow sheet material
PHYSICAL STATE	:	Solid
MOLECULAR WEIGHT	:	N/A
CHEMICAL FORMULA	:	N/A
ODOR	:	Very faint epoxy odor
SPECIFIC GRAVITY	:	(Water=1.0) 2.0+/-0.5
SOLUBILITY IN WATER	:	(weight %) Negligible in water
pH	:	N/A
BOILING POINT	:	N/A
MELTING POINT	:	N/A
VAPOR PRESSURE	:	N/A
VAPOR DENSITY	:	(Air=1.0) N/A
EVAPORATION RATE	:	N/A Compared to : N/A
% VOLATILES	:	N/A
FLASH POINT	:	N/A

(Flash point method and additional flammability data are found in section 5)

10. STABILITY AND REACTIVITY

NORMALLY STABLE ? (CONDITIONS TO AVOID)

Stable

INCOMPATIBILITIES :

Not determined

HAZARDOUS DECOMPOSITION PRODUCTS :

CO, CO2, NOx and HCN if heated in excess of 300 deg.C

HAZARDOUS POLYMERIZATION ?

None known

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS : Dust may cause moderate eye, skin and throat irritation.

DELAYED(SUBCHRONIC & CHRONIC) EFFECTS : None Known

OTHER DATA : N/A

12. ECOLOGICAL INFORMATION

Not Biodegradable

13. DISPOSAL CONSIDERATIONS

RCRA :

Is the unused product a RCRA hazardous waste if discarded ?

No

OTHER DISPOSAL CONSIDERATIONS : Disposal must be made in accordance with all applicable Local, State and Federal regulations. Copper should be recycled.

The information offered here is for the product as shipped. Use and/or alternations the such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT HAZARD CLASS	:	Not regulated
US DOT ID NUMBER	:	N/A

For additional information on shipping regulations affecting this material, contact the information number found on the first page.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA) :

TSCA INVENTORY STATUS :	The resin system components used to make this material are on the TSCA inventory list.
OTHER TSCA ISSUES :	N/A

SARA TITLE III/CERCLA :

RQs & TPQs :

reportable Quantities "(RQs)" and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

	SARA/CERCLA	SARA EHS
Ingredient	RQ(1bs)	TPQ(1bs)
N/A	N/A	N/A

Spills/releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS : N/A

SARA 313 TOXIC CHEMICALS :

The following ingredients are SARA 313 " Toxic Chemicals". CAS#'s and wt.% are found in section #2.

Ingredient	CAS. NO.	Comment
Glass cloth	(65997-17-3)	None
Epoxy	(7328-97-4)	None

STATE RIGHT TO KNOW :

In addition to the ingredients found in section 2, the following are listed for state right-to-know purposes:

Ingredient	Wt. %	Comment
N/A	N/A	N/A

ADDITIONAL REGULATORY INFORMATION :

Doosan Electro-materials does not use polybromide-biphenyls or polybromide-biphenyloxides as a fire retardant in any our epoxy or phenolic systems.

WHMIS CLASSIFICATION (CANADA) : N/A

FOREIGN INVENTORY STATUS : N/A

16. OTHER INFORMATION

CURRENT ISSUE DATE : '06/01/24

PREVIOUS ISSUE DATE : -

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING :

물질안전보건자료(MSDS) 개정 1 판

열경화형 MARKING INK

(SCM-500 BLACK)

1. 화학제품과 회사에 관한 정보

가. 제품명 : 열경화형 MARKING INK(SCM-500 BLACK)
나. 유해성분류 : 비유해성 구성 물질
다. 제품의 용도 : 인쇄회로 기판의 열경화성 MARKING INK
라. 제조자 정보 : (주)서울화학연구소
경기도 시흥시 정왕동 1696-7(시화공단 1 마 605-5)
마. 작성부서 : 개발부
바. 작성일자 : 1997. 6. 16.
사. 개정일자 : 2003. 10. 20.

2. 구성성분의 명칭 및 함유량

구성성분의 명칭 및 함유량	함유(%)	CAS. NO
EPOXY RESIN	42.0	Trade secret
IMIDAZOLE	3.0	931-36-2
PIGMENT	5.0	1333-86-4
INORGANIC FILLERS	30.0	7727-43-7
BUTYL CELLSOLVE ACETATE	10.0	112-07-2
SOLVENT NAPHTHA	10.0	8030-30-6
계	100	

3. 위험, 유해성

가. 긴급한 위험, 유해성 정보 : NA
나. 눈에 대한 영향 : NA
다. 피부에 대한 영향 : NA
라. 흡입시의 영향 : NA
마. 섭취시의 영향 : NA
바. 만성 징후와 증상 : NA

4. 응급조치요령

가. 눈에 들어갔을 때 : 즉시 물로서 15 분간 세안, 의사에게 문의한다.
나. 피부에 접촉했을 때 : 비누와 물로서 세척하고, 가려움증이 지속되면 의사에게 문의한다.
다. 흡입했을 때 : 신선한 공기를 흡입한다.
라. 먹었을 때 : 즉시 전문의사에게 진단을 받는다.
마. 의사의 주의 사항 : 의사의 처방에 따른다.

5. 폭발, 화제 시 대처 방법

가. 인화점 : 180℃
나. 자연 발화점 : NA
다. 최저인화한계치/ 최고 인화한계치 : NA
라. 소방법에 의한 분류 및 규제 내용 : NA
마. 소화제 : CO_2 건조 분말
사. 연소 시 발생 유해 물질 : NA
아. 사용해서는 안 되는 소화제 : 물

6. 누출 사고 시 대처 방법

가. 인체를 보호하기 위해 필요한 조치사항 : 피부나 눈, 의복에 닿지 않도록 한다.
나. 환경을 보호하기 위해 필요한 조치사항 : 해당 국가 법률 및 제 규정에 따른다.
다. 정화 또는 제거 방법 : 흡습성 물질로 흡수 취합하여 용기에 담아 폐기한다.

7. 취급 및 저장방법

가. 안전취급요령 : 취급 시 보호용구를 착용하고, 피부 및 눈동자에 접촉되지 않도록 한다. 원래의 용기를 이용하여 사용하고 사용 후 닫는다.
나. 보관방법 : 직사광선을 피하고, 20 25℃의 온도에서 원래의 용기에 밀폐하여 보관한다.
다. 주의사항 : 필요하다면 (주)서울화학연구소로 문의한다.(TEL : 031-499-0321)

8. 노출방지 및 개인 보호구

가. 공학적 관리 방법 : NA
나. 호흡기 보호 : 필요 시 승인된 보호구
다. 눈 보호 : 필요 시 화학용 보안경
라. 손 보호 : 필요 시 화학용 장갑
마. 신체보호 : 작업복
바. 위생상 주의 사항 : 우발적 노출을 막기위해 개인 위생관리를 엄격히 시행한다.
사. 노출 기준 : NA
아. 기타 : 필요 시 해당장소 환기구 설치

9. 물리적 특성

가. 외관 : 점성이 있는 BLACK 열경화성 MARKING INK
나. 냄새 : 약간 있음
다. pH : NE
라. 용해도 : NE
마. 끓는점/끓는점 범위 : 217℃
바. 녹는점/녹는점 범위 : NA
사. 폭발성 : NA
아. 산화성 : NA
자. 증기압 : 0.09 ㎜ Hg at 25℃
차. 비중 : 1.3 (H_2O = 1)
카. 분배 계수 : NA(NE)
타. 증기 밀도 : 6.1(Air = 1)
파. 점도 : 280 300PS(at 25℃, Viscotester VT-04)

10. 안정성 및 반응성

가. 화학적 안정성 : 불안정
나. 피해야 할 조건 및 물질 : NA
다. 분해 시 생성되는 유해 물질 : NA
라. 반응 시 유해 물질 발생 가능성 : NA

11. 독성에 관한 정보

가. 급성경구 독성 : NA
나. 급성흡입 독성 : NA
다. 아급성 독성 : NA
라. 만성 독성 : NA
마. 변이원성 영향 : NA
바. 차세대 영향(생식독성) : NA
사. 발암성 영향 : NA

12. 환경에 미치는 영향

가. 수생 및 생태 독성 : NA
나. 토양이동성 : NA
다. 잔류성 및 분해성 : NA
라. 동생물의 생체 내 축척 가능성 : NA

13. 폐기 시 주의사항

가. 폐기물 관리법상 규제 현황 : 해당국가 법률 및 규정에 따른다.
나. 폐기 방법 : 해당국가 법률 및 규정에 따른다.

14. 운송에 필요한 정보

가. 선박안전법 위험물 선박 운송 및 저장 규칙에 의한 분류 및 규제 : NA
나. 운송 시 주의사항
① 빗물 등이 투입되지 않도록 주의한다.
② 열 및 직사광선에 주의한다.
③ 용기파손 등으로 인한 누출을 주의한다.

15. 법적 규제 현황

가. 산업안전 보건법에 의한 규제 : 산업 안전 보건법 제 41 조 규정에 따른다.
나. 유해 화학 물질 관리법 등 타 부처의 화학 물질 관리 관련법에 의한 규제 : NA

16. 기타 참고 사항

가. 자료의 출처 : 이 MSDS 는 산업 안전 보건법 제 41 조 규정에 의거하여 산업 위생상 적절한 방법과 관련법에 따라 본 제품을 보관, 취급, 사용해야 함. 본 물질 안전 보건 자료 상의 내용은 현재 본사가 확보하고 있는 지식에 기초하였으며 안전 요건의 관점에서 기술되었음. 따라서 본 자료는 특정 사양을 보증하는 것으로 간주 될 수 없음.

※ NE : 측정할 수 없음.

※ NA : 측정할 수 없거나 유용한 자료가 없음.

Material Safety Data Sheet

Form: 24
Issue Date: 01/13/10
Supersedes: 11/23/05
MSDS Number: Z01391

Zeon Chemicals L. P.

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Manufacturer / Importer:
Zeon Chemicals L.P.
4111 Bells Lane
Louisville, Kentucky 40211

Telephone Number:
1-800-735-3388
(502)-775-2000

Emergency Telephone Number:
1-800-776-2460 Ext 7650
(502) 774-8126

Chemical Family:
Polycycloolefin Resin

Uses:
Optics

This MSDS applies to the following product(s):

Zeonex 330R
Zeonex 340R
Zeonex 480
Zeonex 480R
Zeonex 480S
Zeonex E48R

Section 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredients	CAS #	Amount	Exposure Limits	
			OSHA PEL	ACGIH TLV
None as defined by 29 CFR 1910.1200				

Other Ingredients	CAS #	Amount	Notes
Polycycloolefin Resin	Proprietary	>99 %	TWA = Time Weighted Average TLV = Threshold Limit Value AL = Action Level RD = Respirable Dust TD = Total Dust STEL = Short Term Exposure Limit Skin = Skin contact may be a significant route of exposure A2 = ACGIH Suspected Human Carcinogen A3 = ACGIH Animal Carcinogen A4 = ACGIH Not Classifiable as a Human Carcinogen PNOC = Particulates Not Otherwise Classified

Section 3 - HAZARDS IDENTIFICATION

Emergency Overview:	This product is a colorless transparent pellet, puck, or plaque with no distinctive odor. Processing operations may produce vapors or dust that may cause eye, skin, and respiratory tract irritation. Toxic combustion products may be released under fire conditions. A static charge may be generated during unloading and transport. The static charge may cause a flash fire in the presence of volatile or flammable materials.

Potential Health Effects From Overexposure: Possible routes of entry include skin & eye contact and process vapor or dust inhalation.

No adverse health effects are expected during normal processing when potential exposures are eliminated by good industrial hygiene practice and well ventilated conditions. At processing temperatures, the combined ingredients (Polycycloolefin Resin and other processing ingredients) may emit fumes and vapors that may cause irritation to the eyes, skin, nose, throat, and respiratory tract. Processing under conditions of inadequate ventilation may produce symptoms of nausea, dizziness, or headaches. Typically these effects are reversible upon removal from exposure and no lasting effects are expected. Most importantly, the potential for irritation will depend on the effectiveness of exhaust ventilation provided to the process area.

Contact with molten resin may cause thermal burns.

Overexposure to decomposition or combustion products may cause irritation of the eyes, skin, and respiratory tract. Symptoms such as coughing, tearing, and irritation should be regarded as potentially hazardous and measures taken to avoid exposure. See Section 10 for information on combustion products.

Section 4 - FIRST AID MEASURES

If irritation occurs or persists from any route of exposure, remove the affected individual from the area and seek medical assistance.

Eye Contact: Treat as any foreign particulate matter. Flush eyes with running water for several minutes while holding eyelids open. Consult a physician if irritation persists.

Skin Contact: Remove contaminated clothing. Wash contact area with soap and water for 15 minutes. Seek medical attention if irritation / allergic skin reaction develops. If molten resin contacts skin, cool rapidly with water. Do not attempt to remove resin from skin. Seek medical attention for thermal burn.

Particulate Inhalation: Remove affected individual to fresh air.

Vapor Inhalation (processing vapors or decomposition products): Remove the affected individual to fresh air. If breathing has stopped, administer artificial respiration and seek medical assistance immediately.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media: Water, ABC dry chemical, or Protein type air foams are recommended media. Polycycloolefin Resins would be considered "ordinary combustibles" (NFPA defined Class A). Carbon dioxide is generally not recommended for use on Class A fires as a lack of cooling capacity may result in reignition.

Special Firefighting Procedures: Wear positive pressure self-contained breathing apparatus (SCBA) during the attack phase of firefighting operations and during cleanup in enclosed or poorly ventilated areas immediately after a fire. Personnel not having suitable respiratory protection must leave the area to prevent significant exposure to toxic combustion gases from any source.

Unusual Fire and Explosion Hazards: A static charge may be generated during unloading and transport. The static charge may cause a flash fire in the presence of volatile or flammable materials. Toxic gases may be formed upon combustion and represents a hazard to firefighters. See Section 10 for additional information on combustion products.

Section 6 - ACCIDENTAL RELEASE MEASURES

If the material is released or spilled, sweep, shovel, or vacuum crumbs or chunks into closed containers for reuse or disposal. Prevent pellets from entering waterways.

Section 7 - HANDLING AND STORAGE

Eliminate ignition sources, including static buildup; provide adequate ventilation; bond, ground, and properly vent containers, conveyors, process control devices, and other transfer equipment. Ground all equipment and pour the product slowly into chute or vessel under inert gas when flammable materials are present.

During normal processing, virtually all resins will emit fumes and vapors when heated to processing temperatures. The concentration and composition of these vapors will depend on variables such as the specific formulation and processing method and temperature. Always process resins under well ventilated conditions and avoid continued or prolonged breathing of process vapors. Wash thoroughly after processing compound, especially before eating, smoking, or using toilet facilities. Do not use or consume food in processing areas. Do not use processing equipment to heat food.

Clean up following normal processing should be performed under well ventilated conditions. Polycycloolefin Resins may be held at process temperatures for a short time without significant thermal degradation. However exposure to either elevated temperature or excessive time will result in decomposition. Equipment should not be shut down for extended time periods with compound in it or decomposition may occur.

Processing fume condensates, which may include toxic contaminants, may be combustible and should be periodically removed from exhaust hoods, ductwork, and other surfaces. Protective clothing, including impervious gloves, should be worn during cleanup operations to prevent skin contact.

Store in a cool, dry place away from direct light to maintain quality.

Abnormal conditions such as equipment malfunction or using improper equipment or procedures, or hangup or stagnation of material during processing may cause decomposition. Employees involved in removing decomposing material should be provided suitable air-supplied respirators, such as an approved positive pressure self-contained breathing apparatus.

Compounding ingredients added to Polycycloolefin Resin products may require special handling. It is the users responsibility to follow the recommended precautions of the individual additive suppliers.

Post-processing operations at your workplace or at your customer's workplace involving heat sufficient to result in polymer breakdown emitting smoke and fumes should always be conducted in such a manner to avoid inhalation of fumes. Local exhaust ventilation should be provided to prevent significant employee exposure.

Section 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation: Effective general and, if necessary, local exhaust ventilation must always be provided to draw fumes or vapors away from workers to prevent routine inhalation. Ventilation must be adequate to maintain the ambient workplace atmosphere below the limits listed in Section 2.

Respiratory Protection: Respiratory protection is not typically required during normal use and handling operations where general dilution or local exhaust ventilation is adequate to control exposures. NIOSH approved respiratory protection may be needed if vapor or dust is generated during processing or if the product is ground into a fine powder. Wear a positive pressure air-supplied respirator in situations where there may be potential for elevated airborne exposure such as during equipment malfunction, or product hangup or stagnation during processing that may result in decomposition**.**

Protective Equipment: During processing operations, safety glasses and/or goggles suitable for keeping dust or particulate matter out of the eyes should be worn when eye contact is anticipated. Protective gloves should be worn to prevent skin contact.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Specific Gravity (H_2O=1):	1.01	% Volatile by Weight:	<0.01 (water vapor)
Glass Transition Temperature:	138 - 140^0 C	Solubility in Water:	Practically Insoluble

Appearance and Odor: Colorless, transparent pellet, puck, or plaque with no distinctive odor.

Section 10 - STABILITY AND REACTIVITY

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: Overheating

Materials to Avoid: No specific information is available, however strong oxidizers or reducing agents which are generally not compatible with many organic compounds, are not compatible with Polycycloolefin Resins.

Hazardous Decomposition Products: Fumes produced when heated to decomposition temperatures may contain carbon monoxide, carbon dioxide and small amounts of aromatic and aliphatic hydrocarbons. Combustion products must be considered toxic.

Section 11 - TOXICOLOGICAL INFORMATION

No information available.

Section 12 - ECOLOGICAL INFORMATION

No information available.

Section 13 - DISPOSAL CONSIDERATIONS

Waste resulting from this product as supplied is not known to be classified as a hazardous waste per the current listings and characteristics contained in 40 CFR Part 261, and its Appendices. Resin pellets are classified as "significant materials" under EPA's Storm Water Discharge Regulations. Do not allow resin pellets to enter storm water runoff or other waterways. It is the generator's responsibility to determine, per the regulation, the applicability of the Resource Conservation and Recovery Act (RCRA), as well as all state, local, or other governmental agency waste disposal regulations, to the particular waste materials prior to treatment or disposal.

Section 14 - TRANSPORTATION INFORMATION

For domestic transportation purposes, this product is not defined or designated as a hazardous material by the U.S. Department of Transportation under Title 49 of the Code of Federal Regulations.

DOT Hazard Class	Not Regulated	UN/NA Hazard No.	Not Applicable
DOT Proper Shipping Name	Not Applicable	Reportable Quantity	Not Applicable
DOT Label	Not Applicable		

Section 15 - REGULATORY INFORMATION

TSCA Inventory Status: This product and all components are listed on the U.S. EPA Toxic Substances Control Act Inventory. Zeonex 480S contains a trace quantity of a substance subject to a TSCA SNUR, 40 CFR 721.3486, that prohibits any predictable or purposeful release into the waters of the United States.

TSCA 12(b) Export Notification Status: This product does not contain any components subject to export notification

requirements.

SARA 313 Status: This product does not contain any components exceeding the *de minimis* amount subject to reporting under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40 CFR 372.

Additional Right-to-Know Information on Components:

Component	CAS #	Key (See below)	
Polycycloolefin Resin	Proprietary	7, 13	*

Key	Description	Key	Description
1.	Reserved	8.	MA Extraordinary Hazardous Substance above 1 ppm
2.	CA Listed Carcinogen	9.	MA Toxic or Hazardous Substance above 1%
3.	CA Listed Reproductive Toxin	10.	NJ Hazardous Substance above 1%
4.	PA Special Hazardous Substance above 0.01%	11.	NJ Special Health Hazard Substance above 0.1%
5.	PA Hazardous Substance above 1%	12.	NJ Environmental Hazardous Substance above 1%
6.	PA Non-Hazardous Substance above 3%	13.	NJ Non-Hazardous Substance above 1%
7.	PA Non-Hazardous Substance above 5%	14.	Canadian WHMIS Ingredient Disclosure List Substance

Section 16 - ADDITIONAL INFORMATION

Hazard Rating System Classifications:

	NFPA	**HMIS**	Key: 0=least; 1=slight; 2=moderate; 3=high; 4=extreme
Health	2	0	National Fire Protection Association rating identifies hazards during a fire emergency.
Flammability	1	1	Hazardous Materials Identification System rating applies to products as packaged.
Reactivity	0	0	

It may be possible under certain processing and handling conditions, e.g. processes that create vapors, mists, or dust, to release unreacted monomers and other substances in airborne concentrations in excess of their established exposure limits or guidelines. Customers and processors should do sufficient in-house industrial hygiene monitoring to assure compliance of their operations.

Reason for (Re)issue: Revalidate

User's Responsibility

This bulletin cannot cover all possible situations which the user may experience during processing. Each aspect of your operation must be examined to determine if, or where, additional precautions may be necessary. All health and safety information contained in this bulletin must be provided to your employees or customers. It is your responsibility to use this information to develop appropriate work practice guidelines and employee instructional programs for your operation.

Disclaimer of Liability

As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any use of this material. Information contained herein is believed to be true and accurate but all statements or suggestions are made without warranty, expressed or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable federal, state, and local laws and regulations remains the responsibility of the user.

물질안전보건자료
(Material Safety Data Sheet)

개정 일자 : 2003. 12. 15

물질명	관용명/동의어
골드 시안화 칼륨(GOLD POTASSIUM CYANIDE)	칼륨 시아노아우리트(POTASSIUM CYANOAURITE); 칼륨 금 시아니드(POTASSIUM GOLD CYANIDE); 아우레이트(1 -), 비스(시아노 - C) - , 칼륨(AURATE(1 -), BIS(CYANO - C) - , POTASSIUM); 아우레이트(1 -), 디시아노 - , 칼륨(AURATE(1 -), DICYANO - , POTASSIUM); 칼륨 디시아노아우레이트(I)(POTASSIUM DICYANOAURATE(I)); 칼륨 시아노아우레이트(I)(POTASSIUM CYANOAURATE(I)); 금 칼륨 시아니드(AUK(CN)2)(GOLD POTASSIUM CYANIDE (AUK(CN)2)); 금 칼륨 시아니드(KAU(CN)2)(GOLD POTASSIUM CYANIDE (KAU(CN)2)); 모노칼륨 디시아노아우레이트(MONOPOTASSIUM DICYANOAURATE); 칼륨 아우로시아니드(POTASSIUM AUROCYANIDE); 칼륨 아우로시아니드(KAU(CN)2)(POTASSIUM AUROCYANIDE (KAU(CN)2)); 칼륨 디시아노아우레이트(POTASSIUM DICYANOAURATE); 칼륨 디시아노아우레이트(1 -)(POTASSIUM DICYANOAURATE(1 -)); 비스(시아노 - C) - 아우레이트 CL -) 칼륨(BIS(CYANO - C) - AURATE CL -) POTASSIUM); 디시아노아우레이트(1 -) 칼륨(DICYANOAURATE (1 -) POTASSIUM); ACR 434 골드 메이크 - 업 염(ACR 434 GOLD MAKE - UP SALT (AMERICAN CHEMICAL & REFINING CO., INC.)); C2AuKN2; OHS10550;

CAS NO	RTECS NO	UN NO	EN NO
13967 - 50 - 5		1588	237 - 748 - 4

1. 화학제품과 회사에 관한 정보

물질명: 골드 시안화 칼륨(GOLD POTASSIUM CYANIDE)

동의어/상품명:
칼륨 시아노아우리트(POTASSIUM CYANOAURITE); 칼륨 금 시아니드(POTASSIUM GOLD CYANIDE); 아우레이트(1 -), 비스(시아노 - C) - , 칼륨(AURATE(1 -), BIS(CYANO - C) - ,

POTASSIUM); 아우레이트(1 -), 디시아노 - , 칼륨(AURATE(1 -), DICYANO - , POTASSIUM); 칼륨 디시아노아우레이트(I)(POTASSIUM DICYANOAURATE(I)); 칼륨 시아노아우레이트(I)(POTASSIUM CYANOAURATE(I)); 금 칼륨 시아니드(AUK(CN)2)(GOLD POTASSIUM CYANIDE (AUK(CN)2)); 금 칼륨 시아니드(KAU(CN)2)(GOLD POTASSIUM CYANIDE (KAU(CN)2)); 모노칼륨 디시아노아우레이트(MONOPOTASSIUM DICYANOAURATE); 칼륨 아우로시아니드(POTASSIUM AUROCYANIDE); 칼륨 아우로시아니드(KAU(CN)2)(POTASSIUM AUROCYANIDE (KAU(CN)2)); 칼륨 디시아노아우레이트(POTASSIUM DICYANOAURATE); 칼륨 디시아노아우레이트(1 -)(POTASSIUM DICYANOAURATE(1 -)); 비스(시아노 - C) - 아우레이트 CL -) 칼륨(BIS(CYANO - C) - AURATE CL -) POTASSIUM); 디시아노아우레이트(1 -) 칼륨(DICYANOAURATE (1 -) POTASSIUM); ACR 434 골드 메이크 - 업 염(ACR 434 GOLD MAKE - UP SALT (AMERICAN CHEMICAL & REFINING CO., INC.)); C2AuKN2; OHS10550

화학물질 군: 무기, 염류

작성 일자: 1985.1.7
개정 일자: 2003.12.15

2. 구성성분의 명칭 및 함유량

성분: 골드 시안화 칼륨(GOLD POTASSIUM CYANIDE)
CAS 번호: 13967 - 50 - 5
유럽연합(EC) 번호(EINECS): 237 - 748 - 4
EC 색인 번호: 006 - 007 - 00 - 5
퍼센트(%): 100.0

3. 위험 유해성

NFPA 등급(0 - 4 단계): 보건=2 화재=0 반응성=0

응급상황을 위한 개요:
색상: 무채색에서 흰색까지
물리적 상태: 결정체
주요한 건강위험성: 피부 자극

잠재적 건강영향:
흡입:
단기간 노출: 다른 노출 경로에서 보고된 영향과 같음, 질식
장기간 노출: 구역, 두통, 현기증
피부 접촉:
단기간 노출: 다른 노출 경로에서 보고된 영향과 같음, 자극, 질식
장기간 노출: 중대한 부작용에 대한 정보는 없음
눈 접촉:
단기간 노출: 단기간 섭취시 보고된 영향과 같음, 화상, 시력불선명, 질식
장기간 노출: 장기간 섭취시 보고된 영향과 같음
섭취:
단기간 노출: 발진, 구역, 흉통, 불규칙 심장박동, 두통, 실명, 푸른 빛 피부 색, 질식, 폐 울혈, 마비, 경련, 혼수
장기간 노출: 현기증

발암성:

산업안전보건법 : -
미국 산업안전보건청(OSHA): 아니오
미국 국립독성계획단(NTP): 아니오
국제 발암성연구소(IARC): 아니오

4. 응급조치 요령

흡입: 지역 출입이 안전할 때, 노출로부터 이동할 것. 필요시 인공호흡(구조 호흡)을 할 수 있는 간이구명기 또는 이와 유사한 장치를 사용하도록 함. 즉시 의사의 치료를 받을 것.

피부 접촉: 오염된 의복 및 신발을 벗고, 즉시 적어도 15분 동안 비누와 물로 씻을 것. 필요시 의사의 치료를 받도록 할 것. 오염된 의복 및 신발은 재사용 전에 철저히 건조시키고 세탁할 것.

눈 접촉: 많은 양의 물을 사용하여 적어도 15분 동안 눈을 세척할 것. 곧바로 의사의 치료를 받도록 할 것.

섭취: 소방서(응급구조) 또는 의사에게 즉시 연락할 것. 의식 불명의 사람에게 토하게 하거나 음료수를 마시지 않도록 할 것. 구토를 하면, 구토물이 기도를 막는 것을 방지하기 위하여 머리를 둔부보다 낮추도록 할 것. 만약 사람이 의식 불명이면 머리를 옆으로 돌리게 할 것. 즉시 의사의 치료를 받을 것.

해독제: 아밀 아질산염, 흡입; 나트륨 아질산염, 정맥투여; 나트륨 티오황산염, 수액제로 투여; 산소.

의사에 대한 정보: 5분마다 1앰플(0.2ml)의 아밀 아질산염 흡입과 산소의 공급을 고려할 것. 섭취의 경우에는 위 세척을 고려할 것. 산소의 공급을 고려할 것.

5. 폭발 화재시 대처방법

화재 및 폭발 위험: 화재 위험은 무시할 수 있음. 용기가 열에 노출되면 파열되거나 폭발할 수도 있음.

소화제: 입자상 분말 소화약제, 일반적인 포말, 물

대형 화재: 일반적인 소화약제을 사용하거나 미세한 물 분무로 살수할 것.

소방: 위험없이 할 수 있으면 용기를 화재지역으로 부터 이동시킬 것. 안전한 장소 또는 안전한 거리에서 대형 화재를 진화할 것. 탱크의 양 끝에는 접근하지 말 것. 추후의 처리를 위한 제방을 축조할 것. 누출된 물질에 고압 물줄기를 뿌려 비산되지 않도록 할 것. 주변화재에 적응한 소화제를 사용할 것. 물질자체 또는 연소 생성물의 흡입을 피할 것. 바람을 안고 있도록 하고 저지대를 피할 것.

6. 누출사고시 대처방법

직업적 유출:
누출된 물질을 만지지 말 것. 작업자가 위험없이 누출을 중단시킬 수 있으면 중단시킬 것. 물 분무를 사용하여 증기의 발생을 감소시킬 것. 소량 누출: 모래 또는 다른 비가연성물질을 사용하여 흡수시킬 것. 누출된 물질의 처분을 위해 적당한 용기에 수거할 것. 작은 고체상 유출: 누출지역으로 부터 안전한 지역으로 용기를

이동할 것. 다량 누출: 추후의 처리를 위한 제방을 축조할 것. 관계인 외의 접근을 막고 위험 지역을 격리하며 출입을 금지할 것. 밀폐된 공간에 출입하기 이전에 환기를 할 것. 기준량이상의 배출에 대해서는 중앙정부 및 지방자치단체에 배출내용을 통지할 것.

7. 취급 및 저장방법

저장: 현행법규 및 규정에 의하여 저장 및 취급할 것. 혼합금지 물질과 분리할 것.

8. 노출방지 및 개인보호구

노출기준:
골드 시안화 칼륨(GOLD POTASSIUM CYANIDE):
  시안화물 (as CN)(CYANIDES (as CN)):
    5 ㎎/㎥ OSHA TWA (피부)
    5 ㎎/㎥ ACGIH TWA (피부)
    4.7 ppm (5 ㎎/㎥) NIOSH 권장 ceiling 10 분
    2 ㎎/㎥ DFG MAK (피크 한계 분류 등급 - II, 편위 인자 1) (흡입성 분진 분율) (피부)

환기: 국소배기 또는 공정밀폐 환기장치를 설치할 것. 해당 노출기준에 적합한지 확인할 것.

눈 보호: 비산물 또는 유해한 액체로 부터 보호되는 보안경을 겹쳐 사용할 수 있는 보안면을 착용할 것. 작업장 가까운 곳에 세안설비와 비상세척설비(샤워식)를 설치할 것.

보호의: 적절한 내화학성 보호의를 착용할 것.

안전장갑: 적당한 내화학성 장갑을 착용할 것.

호흡 보호구: 호흡용 보호구는 한국산업안전공단의 검정("안" 마크)을 필할 것.
  다음 호흡용보호구 및 최대 사용 농도는 미국 국립산업안전보건연구소(NIOSH)및/또는 미국 산업안전보건청(OSHA)에서 작성한 것임.
  측정 요소:
  시안(CN)
25 ㎎/㎥
  송기마스크.
  공기호흡기(전면형).
대피 -
  공기여과식 호흡보호구(전면형, 이물질에 대하여 보호할 수 있는 정화통 및 고효율 미립자 여과재).
  공기호흡기(대피용).
미지농도 또는 기타 생명이나 건강에 급박한 위험이 있는 경우 -
  송기마스크(복합식 에어라인 마스크).
  공기호흡기(전면형).

9. 물리화학적 특성

물리적 상태 : 고체

색상: 무채색에서 흰색까지
물리적 상태: 결정체
냄새: 없음
분자량: 288.32
분자식: C2 - AU - N2.K
끓는점: 해당 안됨
녹는점: 없음
증기압: 해당 안됨
증기 밀도: 해당 안됨
비중(물=1): 3.45
물 용해도: 가용성
수소이온지수(pH): 해당 안됨
휘발성: 해당 안됨
취기한계: 없음
증발율: 해당 안됨
옥탄올/물 분배계수: 없음
용매 가용성:
  약 용해성: 알코올
  불용성: 에테르

10. 안정성 및 반응성

반응성: 상온 상압에서 안정함.

피해야 할 조건: 열, 화염, 스파크 및 기타 점화원을 피할 것. 용기가 열에
  노출되면 파열되거나 폭발할 수도 있음.

혼합금지 물질: 염기, 산, 산화제, 할로겐, 금속

위험한 분해생성물:
  열분해생성물: 질소 산화물, 시안화물

중합 반응: 중합하지 않음.

11. 독성에 관한 정보

골드 시안화 칼륨(GOLD POTASSIUM CYANIDE):
발암성: 산업안전보건법 : -
국소 영향:
  자극제: 피부
표적 장기: 혈액
노출에 의해 위험이 증가될 수 있는 경우: 심장 또는 심혈관계 이상, 심장 이상,
  호흡기계 이상, 피부 질환 및 알레르기

12. 환경에 미치는 영향

자료 없음

13. 폐기시 주의사항

적용 규정에 따라 폐기할 것.

14. 운송에 필요한 정보

미국 DOT(교통부) 49 CFR(연방법령) 172.101:
적정 선적명: 시안화물, 무기물, 고체, (골드 시안화 칼륨(GOLD POTASSIUM CYANIDE))
ID 번호: UN1588
위험 분류 또는 등급: 6.1
포장 등급: II
경고표지 부착 요구: 6.1

15. 법적 규제현황

골드 시안화 칼륨(GOLD POTASSIUM CYANIDE)
한국 규정:
- 산업안전보건법 : " - "
- 유해화학물질관리법 : 유독물
- 위험물안전관리법 : " - "

미국 규정:
CERCLA 103 규정 (40CFR302.4):
시안화물, 용해성 염과 착물(CYANIDES, SOLUBLE SALTS AND COMPLEXES): 10 LBS RQ

SARA 302 규정 (40CFR355.30): 규제대상 아님.

SARA 304 규정 (40CFR355.40): 규제대상 아님.

SARA 위험구분, SARA 311/312 규정(40CFR370.21):
급성: 네
만성: 아니오
화재: 아니오
반응성: 아니오
갑작스런 배출: 아니오

SARA 313 규정 (40CFR372.65):
시안화물, 용해성 염과 착물(CYANIDES, SOLUBLE SALTS AND COMPLEXES)

OSHA 규정(29CFR1910.119): 규제대상 아님.

주 규정:
캘리포니아 제안 65호(음용수 처리 규정): 규제대상 아님.

유럽연합 규정:
유럽연합(EC) 확정분류:
T+ 고독성물질
N 환경유해물질

유럽연합의 분류는 독자적인 연구자료에 의하므로 일치하지 않을 수 있음.

위험/유해 기호:
T+ 고독성물질

N 환경유해물질

유럽연합(EC) 위험 및 안전구문:

R 26/27/28 흡입 또는 피부와 접촉하거나 삼키면 매우 독성이 강함.
R 32 산과 접촉하면 매우 유독한 가스가 발생됨.
R 50/53 수생생물에 독성이 높고, 수생환경에 장기적 악영향을 유발할 수 있음.

S 1/2 시건장치를 하고 어린이의 손에 닿지 않는 곳에 보관할 것.
S 7 용기를 밀폐할 것.
S 28 피부에 접촉된 후에는 많은 양의 중성 비누와 물을 사용하여 즉시 세척할 것.
S 29 하수구로 버리지 말 것.
S 45 사고가 발생했거나 건강이 나쁘다고 느끼면 즉시 의사의 조언을 구할 것. (가능하면 경고표지 및 물질안전보건자료를 함께 제공토록 함.)
S 60 이 물질과/또는 용기는 유해폐기물로 구분하여 처분할 것.
S 61 환경으로 배출을 피할 것. 환경관련법령 및 물질안전보건자료를 참고할 것.

국가 물품목록 현황:

미국 물품 목록 (TSCA): 물품 목록에 있음.

TSCA 12(b) 수출 통지: 목록에 없음.

16. 기타 참고사항

이 물질안전보건자료(MSDS)는 화학물질에 대한 근로자의 건강장해 예방을 위하여 한국산업안전공단이 미국 MDL사로부터 미국 MDL사가 보유하고 있는 MSDS를 도입하여 원본 또는 일부를 수정하여 제공하는 것인 바, 산업안전보건법 제41조에 따라 각 사업장 실정에 맞게 근로자의 안전보건에 관해서만 활용하시기 바랍니다.

모든 MSDS는 내부적인 용도로만 사용이 가능하며, 외부적(상업적)인 용도로의 사용이 금지됩니다. 외부적인 용도로 사용하는 경우에는 저작권법 등 관련법규에 따라 처벌될 수 있습니다.

외부적 용도로 사용하시고자 할 경우에는 주식회사 바이텍켐스(www.chems.co.kr, 전화번호 02 - 551 - 0501)로 문의하여 주시기 바랍니다.

Test Report No. F690501/LF-CTSAYAA11-10960

Issued Date: 2011. 04. 08

To: **SEOUL CHEMICAL RESEARCH LABORATORY CO., LTD.**
1ma 605-5 Shihwa Ind. Com.
1696-7 Jungwang-dong
Shiheung-si
Gyeonggi-do 429-450
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	:	AYAA11-10960
Product Name	:	SCM-500 Black
Item No./Part No.	:	SCM-500 Matt Black
Received Date	:	2011. 04. 01
Test Period	:	2011. 04. 04 to 2011. 04. 08
Test Results	:	For further details, please refer to following page(s)
Test Performed	:	SGS Korea tested the sample(s) selected by applicant with following results.

SGS Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Sample No. : AYAA11-10960.001

Sample Description : SCM-500 Black

Item No./Part No. : SCM-500 Matt Black

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.
Beryllium (Be)	mg/kg	With reference to EPA 3050B(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Sb (Sb2O3)	mg/kg	With reference to EPA 3052(1996), US EPA 6010B(1996), ICP	10	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Sample No. : AYAA11-10960.001

Sample Description : SCM-500 Black

Item No./Part No. : SCM-500 Matt Black

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

Phthalates

Test Items	Unit	Test Method	MDL	Results
Di-(2-ethylhexyl) phthalate (DEHP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.
Di-n-octyl phthalate (DNOP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.
Dibutyl phthalate (DBP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.
Butylbenzyl phthalate (BBP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.
Diisodecyl phthalate (DIDP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.
Diisononyl phthalate (DINP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.
Diisobutyl Phthalate (DIBP)	mg/kg	With reference to ASTM D3421-75 , GC-MS	50	N.D.

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007 , IC	30	337

Organotin Compounds

Test Items	Unit	Test Method	MDL	Results
Dibutyltin (DBT)	mg/kg	DIN 38407-13 , GC/MS	0.1	N.D.
Tributyltin (TBT)	mg/kg	DIN 38407-13 , GC/MS	0.1	N.D.
Triphenyltin (TPhT)	mg/kg	DIN 38407-13 , GC/MS	0.1	N.D.
Dioctyltin(DOT)	mg/kg	DIN 38407-13 , GC/MS	0.1	N.D.

NOTE:

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(6) * = Boiling-water-extraction:
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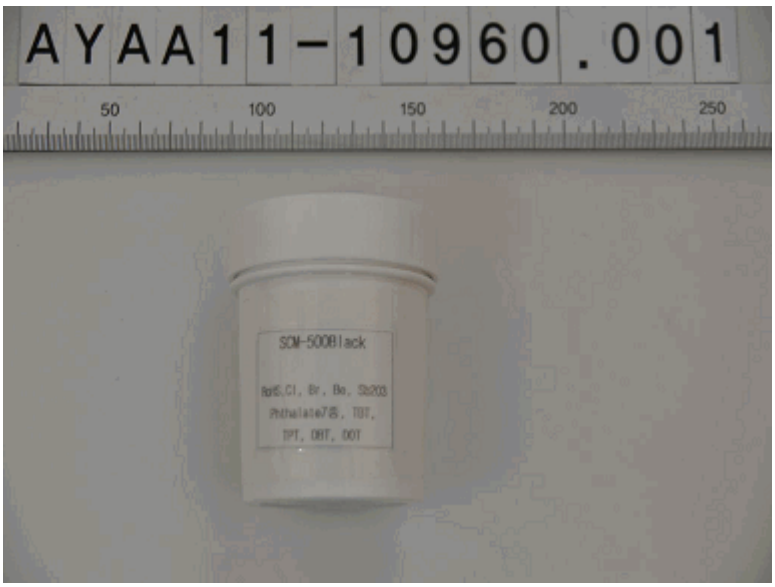
Picture of Sample as Received:



NOTE:

(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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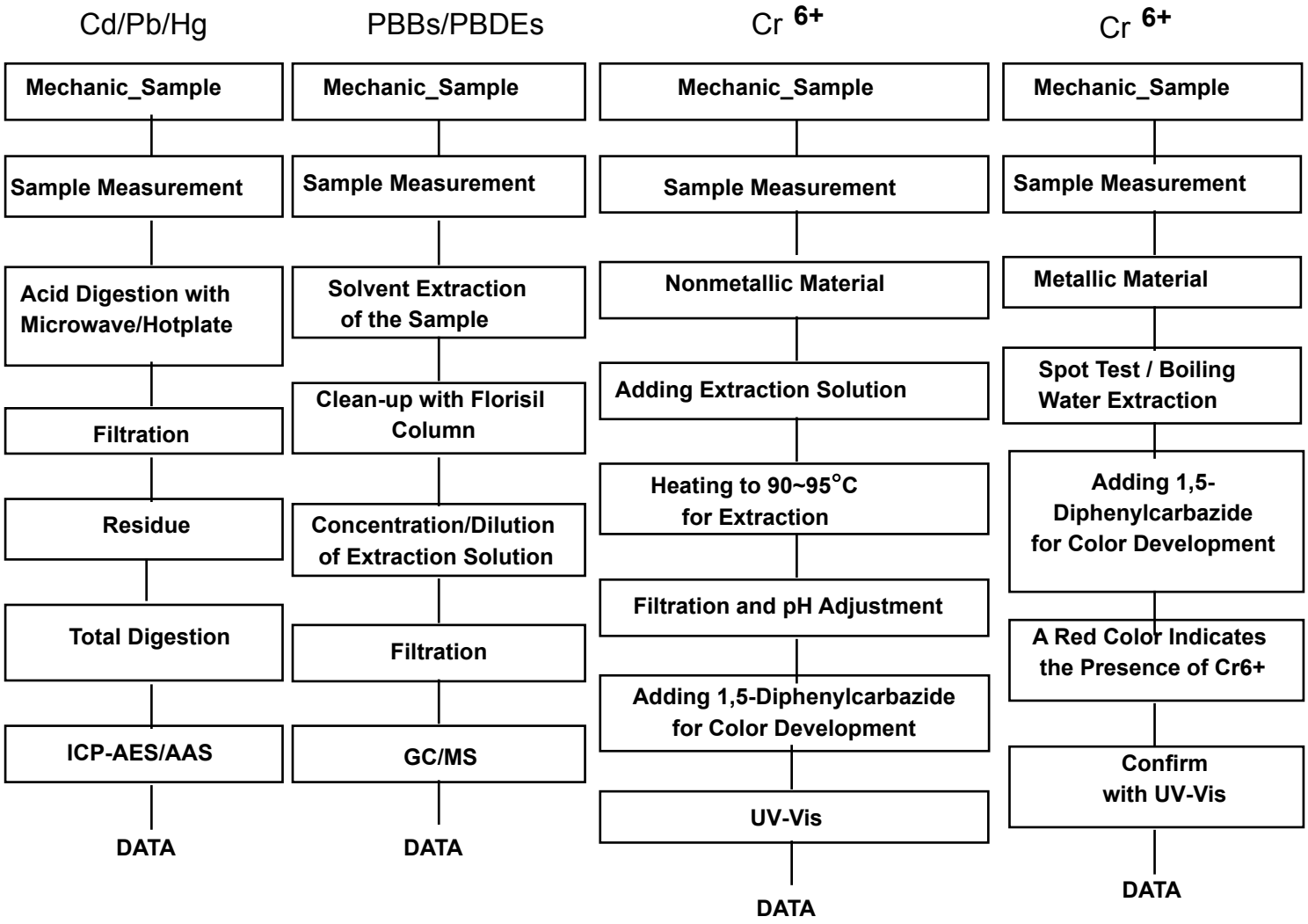
Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+}/PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Section Chief : Gilsae Yi

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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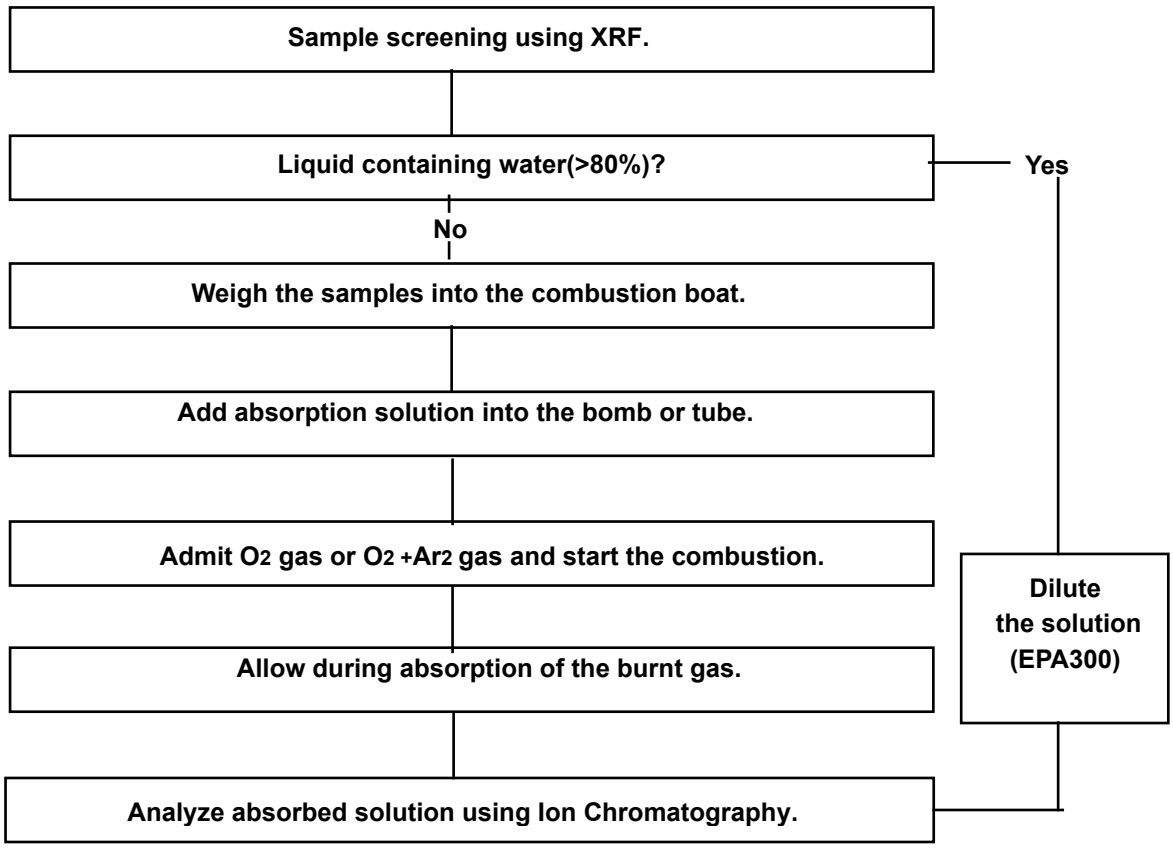
Flow Chart for Halogen Test



*** End ***

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
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Test Report No. F690501/LF-CTSAYN11-001733

Issued Date: 2011. 02. 11

To: **LS MTRON LTD.**
938-1, Jeongeup 3 Industrial Complex
Taegok-ri, Buk-myeon
Jeongeup-city
JEONBUK
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA11-04592
Product Name	: Copper Foil
Item No./Part No.	: UCF-STN
Received Date	: 2011. 02. 09
Test Period	: 2011. 02. 10 to 2011. 02. 11
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results.

SGS Testing Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr ,www.kr.sgs.com/greenlab

Sample No. : 001

Sample Description : Copper Foil

Item No./Part No. : UCF-STN

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Hexavalent Chromium (Cr VI) By boiling water extraction*	**	With reference to IEC 62321:2008	-	Negative

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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Picture of Sample as Received:

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
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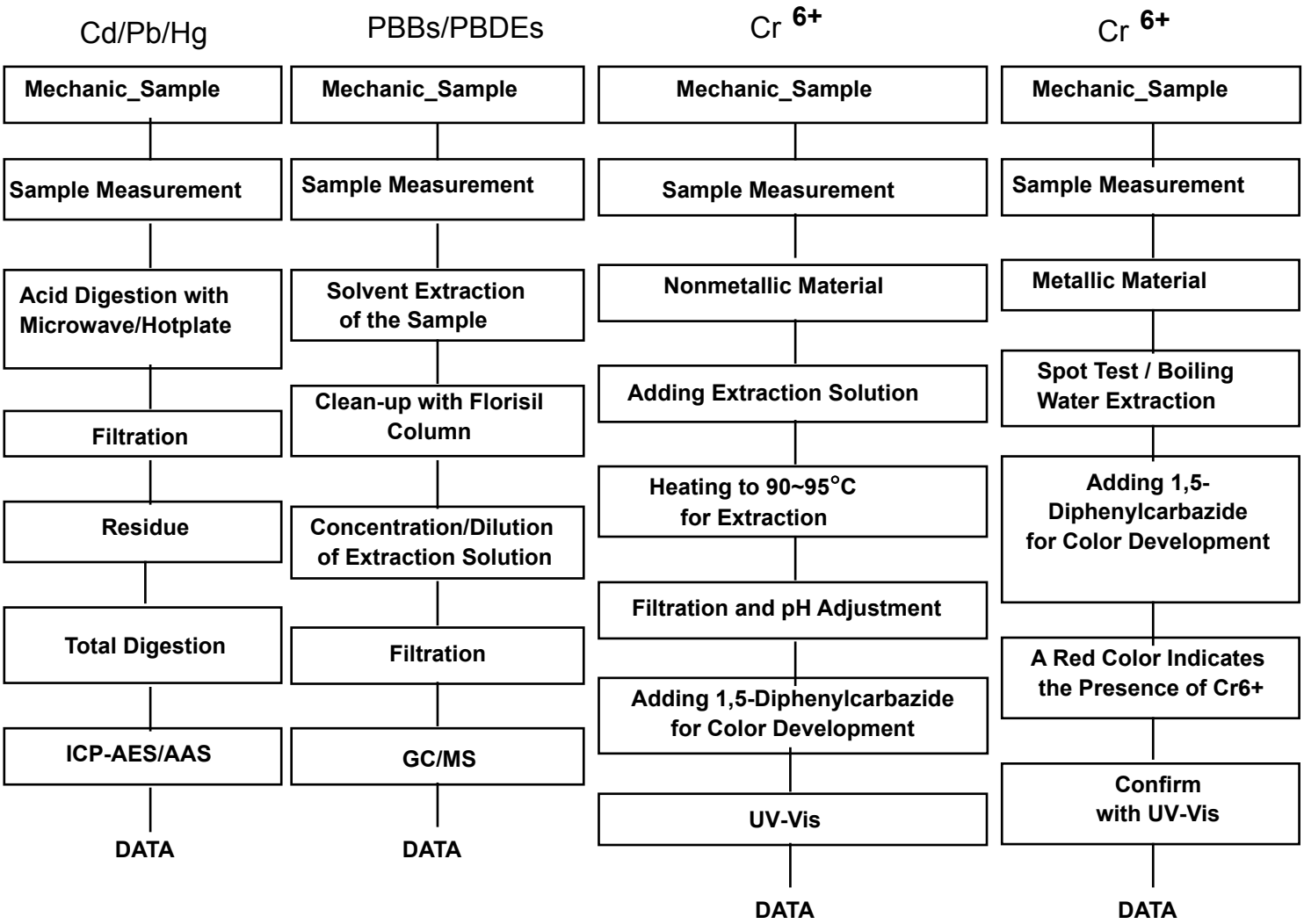
Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+}/PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Section Chief : Gilsae Yi

*** End ***

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
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測試報告
Test Report

號碼(No.) : CE/2011/75061　日期(Date) : 2011/08/02　頁數(Page) : 1 of 4

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

以下測試樣品係由客戶送樣，且由客戶聲稱並經客戶確認如下 (The following samples was/were submitted and identified by/on behalf of the client as)：

樣品名稱(Sample Description)	:	CYCLO OLEFIN POLYMER
樣品型號(Style/Item No.)	:	ZEONEX 480R (LOT NO.0Y03103)
收件日期(Sample Receiving Date)	:	2011/7/27
測試期間(Testing Period)	:	2011/7/27 TO 2011/08/02

==========

測試結果(Test Results) : 請見下一頁 (Please refer to next pages).

Shinjyh Chen / Asst. Manager
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

測試報告
Test Report

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

測試結果(Test Results)

測試部位(PART NAME) No.1 : 透明色塑膠粒 (TRANSPARENT PLASTIC PELLETS)

測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測極限值 (MDL)	結果 (Result) No.1
鹵素 / Halogen				
鹵素 (氟) / Halogen-Fluorine (F) (CAS No.: 14762-94-8)	mg/kg	參考BS EN 14582:2007, 以離子層析儀分析. / With reference to BS EN 14582:2007. Analysis was performed by IC.	50	n.d.
鹵素 (氯) / Halogen-Chlorine (Cl) (CAS No.: 22537-15-1)			50	n.d.
鹵素 (溴) / Halogen-Bromine (Br) (CAS No.: 10097-32-2)			50	n.d.
鹵素 (碘) / Halogen-Iodine (I) (CAS No.: 14362-44-8)			50	n.d.

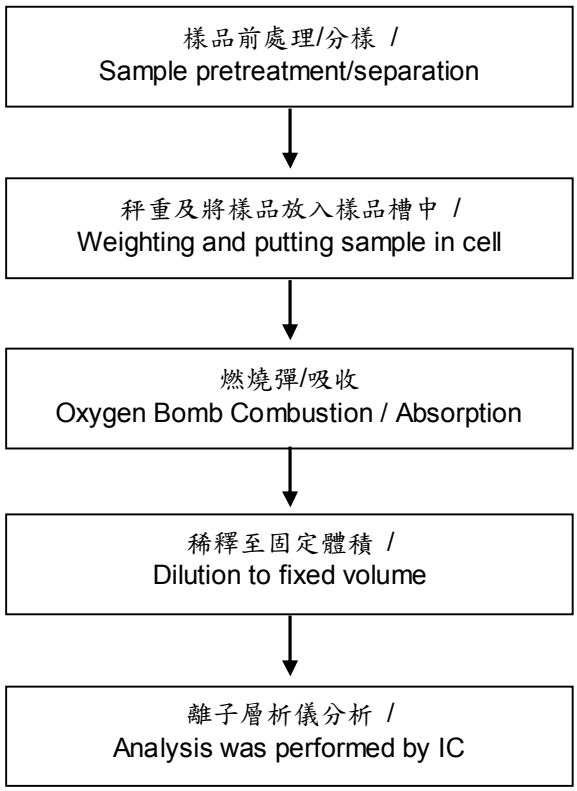
備註(Note):

1. mg/kg = ppm; 0.1wt% = 1000ppm
2. n.d. = Not Detected (未檢出)
3. MDL = Method Detection Limit (方法偵測極限值)

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

鹵素分析流程圖 / Analytical flow chart of halogen content

1) 測試人員：陳恩臻 / Name of the person who made measurement: Rita Chen
2) 測試負責人：張啓興 / Name of the person in charge of measurement: Troy Chang



測試報告
Test Report

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

** 報告結尾(End of Report) **

測試報告
Test Report

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

以下測試樣品係由客戶送樣，且由客戶聲稱並經客戶確認如下 (The following samples was/were submitted and identified by/on behalf of the client as)：

樣品名稱(Sample Description)	:	CYCLO OLEFIN POLYMER
樣品型號(Style/Item No.)	:	ZEONEX 480R (LOT NO.0Y03103)
收件日期(Sample Receiving Date)	:	2011/07/27
測試期間(Testing Period)	:	2011/07/27 TO 2011/08/02

==========

測試需求(Test Requested) : 依據客戶指定，檢測可塑劑含量. (As specified by client, determine Phthalates content in the submitted sample(s).)

測試方法(Test Method) : 請見下一頁 (Please refer to next pages.)

測試結果(Test Results) : 請見下一頁 (Please refer to next pages.)

SGS TAIWAN LTD SGS TAIWAN

Shinjyh Chen / Asst. Manager
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

測試報告
Test Report

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

測試結果(Test Results)

測試部位(PART NAME) No.1 : 透明色塑膠粒 (TRANSPARENT PLASTIC PELLETS)

測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測極限值 (MDL)	結果 (Result) No.1
可塑劑定量分析 / Phthalates				
鄰苯二甲酸甲苯基丁酯 / BBP (Benzyl butyl phthalate) (CAS No.: 85-68-7)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.003	n.d.
鄰苯二甲酸二 (2-乙基己基)酯 / DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.003	n.d.
鄰苯二甲酸二異癸酯 / DIDP (Di-isodecyl phthalate) (CAS No.: 26761-40-0)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.01	n.d.
鄰苯二甲酸二異壬酯 / DINP (Di-isononyl phthalate) (CAS No.: 28553-12-0)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.01	n.d.
鄰苯二甲酸二正辛酯 / DNOP (Di-n-octyl phthalate) (CAS No.: 117-84-0)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.003	n.d.
鄰苯二甲酸二丁酯 / DBP (Dibutyl phthalate) (CAS No.: 84-74-2)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.003	n.d.
鄰苯二甲酸二己酯 / DNHP (Di-n-hexyl phthalate) (CAS No.: 84-75-3)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.003	n.d.
鄰苯二甲酸二 (2-甲氧基乙基)酯 / DMEP (Bis (2-methoxyethyl) phthalate) (CAS No.: 117-82-8)	%	參考EN 14372, 以氣相層析儀/質譜儀檢測之. / With reference to EN 14372. Analysis was performed by GC/MS.	0.003	n.d.

備註(Note):

1. mg/kg = ppm；0.1wt% = 1000ppm
2. n.d. = Not Detected (未檢出)
3. MDL = Method Detection Limit (方法偵測極限值)

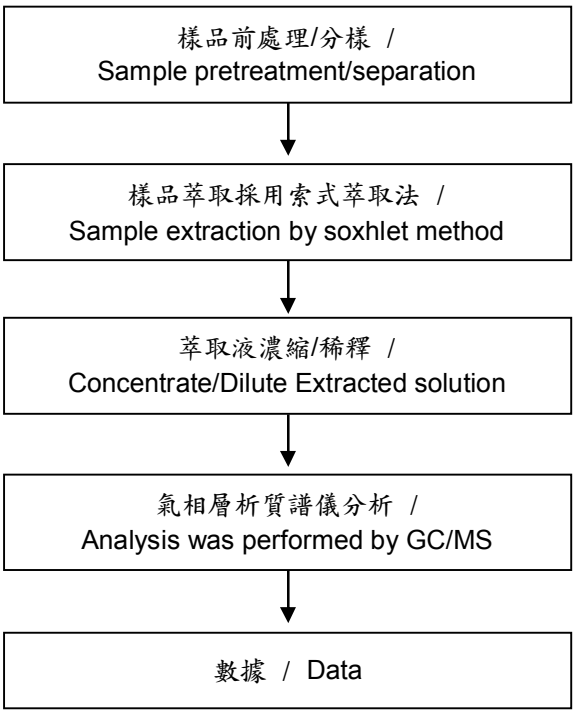
ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

索式萃取(GC/MS)分析流程圖 /
Analytical flow chart of Soxhlet extraction (GC/MS) procedure

1) 測試人員：翁賜彬 / Name of the person who made measurement: Roman Wong

2) 測試負責人：張啓興 / Name of the person in charge of measurement: Troy Chang

■ 測試項目(Test Items): 可塑劑 / Phthalate



測試報告
Test Report

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

** 報告結尾(End of Report) **

測試報告
Test Report

號碼(No.) : CE/2011/75058　　日期(Date) : 2011/08/02　　頁數(Page): 1 of 6

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

以下測試樣品係由客戶送樣，且由客戶聲稱並經客戶確認如下 (The following samples was/were submitted and identified by/on behalf of the client as)：

樣品名稱(Sample Description)	:	CYCLO OLEFIN POLYMER
樣品型號(Style/Item No.)	:	ZEONEX 480R (LOT NO.0Y03103)
收件日期(Sample Receiving Date)	:	2011/7/27
測試期間(Testing Period)	:	2011/7/27 TO 2011/08/02

==========

測試需求(Test Requested) : 參照RoHS 2011/65/EU Annex II 指令要求. (In accordance with the RoHS Directive 2011/65/EU Annex II).

測試結果(Test Results) : 請見下一頁 (Please refer to next pages).

Chenyu Kung / Operation Manager
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory – Taipei

測試報告
Test Report

ZEON CORPORATION
1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

測試結果(Test Results)

測試部位(PART NAME)No.1　　:　透明色塑膠粒 (TRANSPARENT PLASTIC PELLETS)

測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測極限值 (MDL)	結果 (Result) No.1
鎘 / Cadmium (Cd)	mg/kg	參考IEC 62321: 2008方法, 以感應耦合電漿原子發射光譜儀檢測. / With reference to IEC 62321: 2008 and performed by ICP-AES.	2	n.d.
鉛 / Lead (Pb)	mg/kg		2	n.d.
汞 / Mercury (Hg)	mg/kg		2	n.d.
六價鉻 / Hexavalent Chromium Cr(VI)	mg/kg	參考IEC 62321: 2008方法, 以UV-VIS檢測. / With reference to IEC 62321: 2008 and performed by UV-VIS.	2	n.d.
多溴聯苯總和 / Sum of PBBs	mg/kg	參考IEC 62321: 2008方法, 以氣相層析儀/質譜儀檢測. / With reference to IEC 62321: 2008 and performed by GC/MS.	-	n.d.
一溴聯苯 / Monobromobiphenyl	mg/kg		5	n.d.
二溴聯苯 / Dibromobiphenyl	mg/kg		5	n.d.
三溴聯苯 / Tribromobiphenyl	mg/kg		5	n.d.
四溴聯苯 / Tetrabromobiphenyl	mg/kg		5	n.d.
五溴聯苯 / Pentabromobiphenyl	mg/kg		5	n.d.
六溴聯苯 / Hexabromobiphenyl	mg/kg		5	n.d.
七溴聯苯 / Heptabromobiphenyl	mg/kg		5	n.d.
八溴聯苯 / Octabromobiphenyl	mg/kg		5	n.d.
九溴聯苯 / Nonabromobiphenyl	mg/kg		5	n.d.
十溴聯苯 / Decabromobiphenyl	mg/kg		5	n.d.

測試報告
Test Report

ZEON CORPORATION

1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測極限值 (MDL)	結果 (Result)
				No.1
多溴聯苯醚總和 / Sum of PBDEs	mg/kg	參考IEC 62321: 2008方法, 以氣相層析儀/質譜儀檢測. / With reference to IEC 62321: 2008 and performed by GC/MS.	-	n.d.
一溴聯苯醚 / Monobromodiphenyl ether	mg/kg		5	n.d.
二溴聯苯醚 / Dibromodiphenyl ether	mg/kg		5	n.d.
三溴聯苯醚 / Tribromodiphenyl ether	mg/kg		5	n.d.
四溴聯苯醚 / Tetrabromodiphenyl ether	mg/kg		5	n.d.
五溴聯苯醚 / Pentabromodiphenyl ether	mg/kg		5	n.d.
六溴聯苯醚 / Hexabromodiphenyl ether	mg/kg		5	n.d.
七溴聯苯醚 / Heptabromodiphenyl ether	mg/kg		5	n.d.
八溴聯苯醚 / Octabromodiphenyl ether	mg/kg		5	n.d.
九溴聯苯醚 / Nonabromodiphenyl ether	mg/kg		5	n.d.
十溴聯苯醚 / Decabromodiphenyl ether	mg/kg		5	n.d.

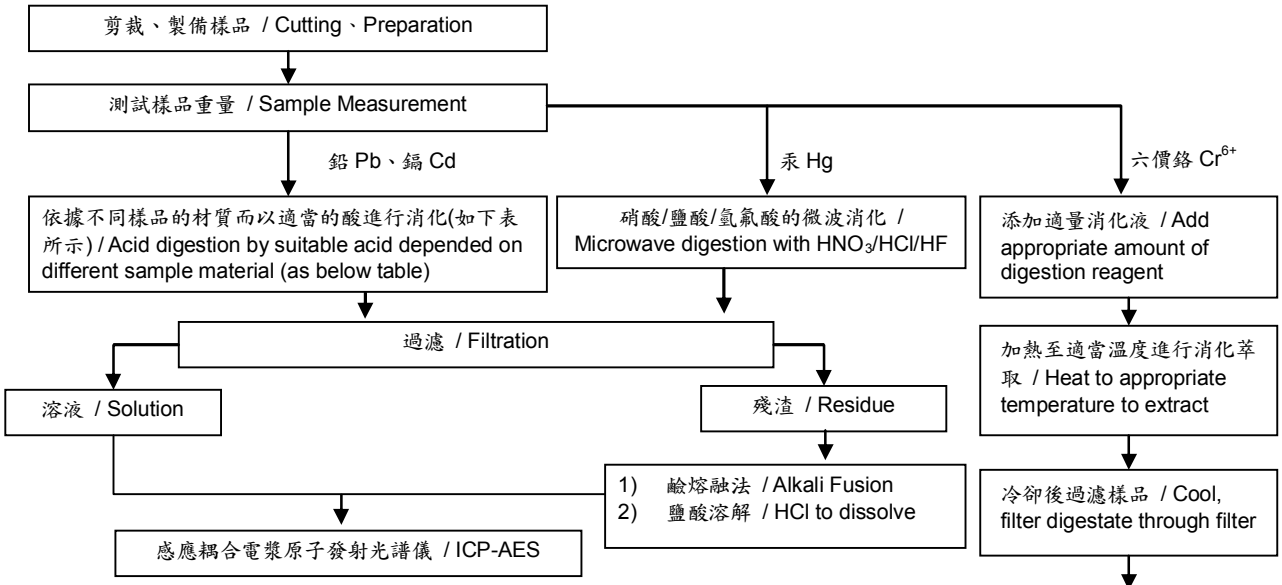
備註(Note)：

1. mg/kg = ppm；0.1wt% = 1000ppm
2. n.d. = Not Detected (未檢出)
3. MDL = Method Detection Limit (方法偵測極限值)
4. "-" = Not Regulated (無規格值)

ZEON CORPORATION

1-6-2 MARUNOUCHI, CHIYODA-KU, TOKYO, 100-8246, JAPAN

1) 根據以下的流程圖之條件，樣品已完全溶解。(六價鉻測試方法除外) / These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr^{6+} test method excluded)
2) 測試人員：楊登偉 / Name of the person who made measurement: Climbgreat Yang
3) 測試負責人：張啓興 / Name of the person in charge of measurement: Troy Chang



樣品材質 / Sample Material	消化酸液種類 / Digestion Acid
鋼, 銅, 鋁, 焊錫 / Steel, copper, aluminum, solder	王水, 硝酸, 鹽酸, 氫氟酸, 雙氧水 / Aqua regia, HNO_3, HCl, HF, H_2O_2
玻璃 / Glass	硝酸,氫氟酸 / HNO_3/HF
金, 鉑, 鈀, 陶瓷 / Gold, platinum, palladium, ceramic	王水 / Aqua regia
銀 / Silver	硝酸 / HNO_3
塑膠 / Plastic	硫酸, 雙氧水, 硝酸, 鹽酸 / H_2SO_4, H_2O_2, HNO_3, HCl
其他 / Others	加入任何酸至完全溶解 / Any acid to total digestion

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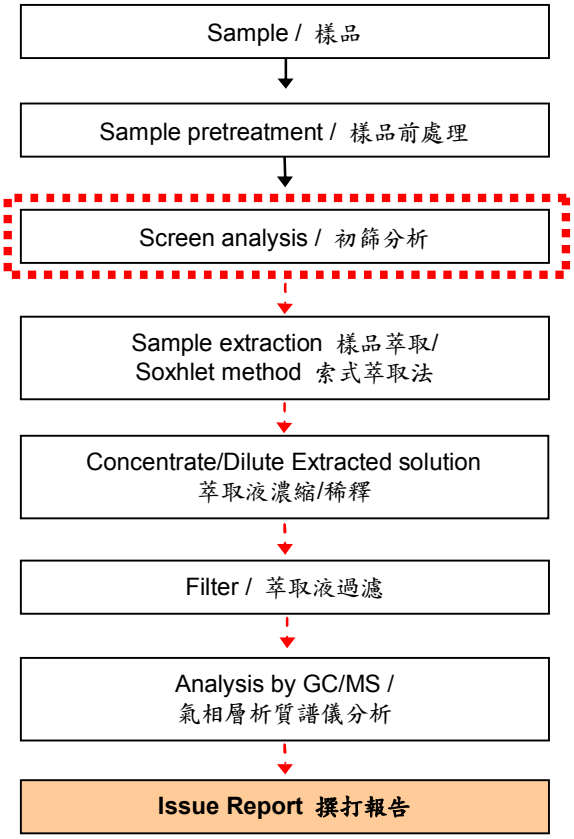
多溴聯苯/多溴聯苯醚分析流程圖 / PBB/PBDE analytical FLOW CHART

- 測試人員：翁賜彬 / Name of the person who made measurement: Roman Wong
- 測試負責人：張啓興 / Name of the person in charge of measurement: Troy Chang

初次測試程序 / First testing process ——→
選擇性篩檢程序 / Optional screen process ·····
確認程序 / Confirmation process — · — →



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** 報告結尾 (End of Report) **

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以下測試樣品係由客戶送樣，且由客戶聲稱並經客戶確認如下 (The following samples was/were submitted and identified by/on behalf of the client as)：

樣品名稱(Sample Description)	:	CYCLO OLEFIN POLYMER
樣品型號(Style/Item No.)	:	ZEONEX 480R (LOT NO.0Y03103)
收件日期(Sample Receiving Date)	:	2011/7/27
測試期間(Testing Period)	:	2011/7/27 TO 2011/08/02

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測試結果(Test Results) : 請見下一頁 (Please refer to next pages).

SGS TAIWAN LTD. SGS TAIWAN

Chenyu Kung / Operation Manager
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory – Taipei

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測試結果(Test Results)

測試部位(PART NAME)No.1 : 透明色塑膠粒 (TRANSPARENT PLASTIC PELLETS)

測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測極限值 (MDL)	結果 (Result) No.1
銻 / Antimony (Sb)	mg/kg	參考US EPA 3050B方法, 以感應耦合電漿原子發射光譜儀檢測銻含量. / With reference to US EPA Method 3050B for Antimony Content. Analysis was performed by ICP-AES.	2	n.d.
鈹 / Beryllium (Be)	mg/kg	參考US EPA 3050B方法, 以感應耦合電漿原子發射光譜儀檢測鈹含量. / With reference to US EPA Method 3050B for Beryllium Content. Analysis was performed by ICP-AES.	2	n.d.

備註(Note):

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. n.d. = Not Detected (未檢出)
3. MDL = Method Detection Limit (方法偵測極限值)

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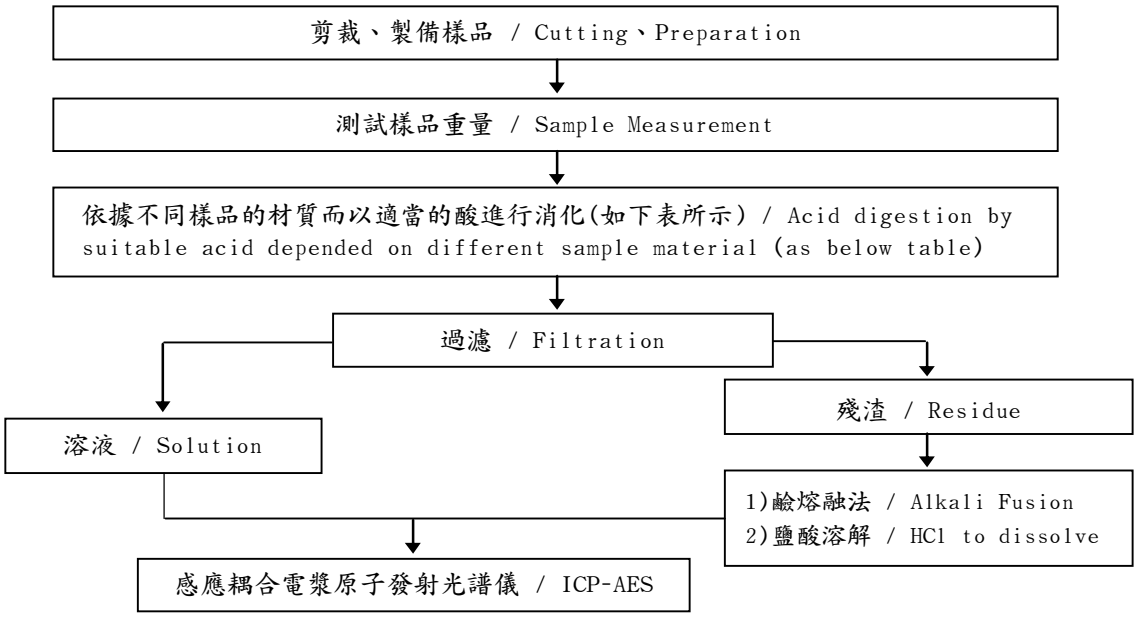
1) 根據以下的流程圖之條件，樣品已完全溶解。 / These samples were dissolved totally by pre-conditioning method according to below flow chart.
2) 測試人員：楊登偉 / Name of the person who made measurement: Climbgreat Yang
3) 測試負責人：張啓興 / Name of the person in charge of measurement: Troy Chang

元素以 ICP-AES 分析的消化流程圖

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



鋼,銅,鋁,焊錫 / Steel, copper, aluminum, solder	王水,硝酸,鹽酸,氫氟酸,雙氧水 / Aqua regia, HNO_3, HCl, HF, H_2O_2
玻璃 / Glass	硝酸,氫氟酸 / HNO_3/HF
金,鉑,鈀,陶瓷 / Gold, platinum, palladium, ceramic	王水 / Aqua regia
銀 / Silver	硝酸 / HNO_3
塑膠 / Plastic	硫酸,雙氧水,硝酸,鹽酸 / H_2SO_4, H_2O_2, HNO_3, HCl
其他 / Others	加入任何酸至完全溶解 / Any acid to total digestion

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