반도체 부품 초정밀 화학세정 기술

Semiconductor Parts ultra-precise Cleaning Technology

1. Aluminum Parts Cleaning
2. Anodized Aluminum parts Cleaning
3. Ceramic Parts Cleaning
4. Quartz Parts Cleaning
5. Stainless Steel Parts Cleaning

SUMMARY

반도체 장치에 사용되는 부품의 재질은 알루미늄, 석영, 세라믹, 스테인리스 스틸 등이며, 공정에 따라 다양한 형태로 제작됩니다.
공정이 진행되면서 이와 같은 부품에는 Metal, Carbon, Oil, Wax, residue Resist, Fingerprint 및 다양한 복합물이 축적됩니다. 이를 제거하기 위한 세정 방법은 Chemical을 사용하는 Wet Cleaning 과 더불어 Dry Cleaning (Bead blasting), Water Jet, CO2 Spray, Ultra Sonic, 플라즈마 등의 방법이 동원됩니다.
Wet Cleaning의 장점은 세정 Cost 및 생산성이 높은 장점이 있으나, 현재 사용하는 세정제를 요약하면 APM(SC-1) NH4OH/H2O2/H2O 파티클 제거, HPM(SC-2) HCl/H2O2/H2O 금속 불순물제거, PM H2SO4/H2O2 유기물제거, DHF HF/H2O 자연 산화막 제거, BHF NH4F/HF/H2O 산화막 제거, 식각, FPM HF/H2O2 금속 불순물제거, 오존불산 HF/O3/H2O 산화막 제거 목적 등 입니다. 이러한 전통적이 세정제를 사용하는 이유는 반도체 부품에 부착된 오염물의 성상이 상기에 열거한 유독하고 부식성이 강한 화공약품으로 조합되어 사용 할 수 밖에 없습니다. 기존에 사용하고 있는 상기 세정제의 조합은 범용적이고 저비용으로 조달 할 수 있고, 부품에 형성된 Deposits 을 제거 할 수 는 있으나, 대부분의 부품의 재질과 선택비가 낮아 부품의 손상을 야기 할 수 밖에 없는 현실입니다.
예를 들면, 알루미늄 소재의 경우 다양한 물질이 Deposition 되어 있는데, 상기에 열거한 세정제 조합에서는 모두 소재의 Damage를 유발합니다.
이를 극복하기 위해 해당 업계에서는 다양한 물리적 세척 방법을 병합하여 사용하고 있으며, 표면 손상 최소화의 노력을 기울이고 있습니다.
더 나아가, 반도체 부품은 Deposits 의 제거 뿐 만 아니라, 오염원 탈락의 방지를 위한 이상적이 표면 조도 및 표면 Morphology 가 요구 됩니다.
최근에는 반도체 회로의 선폭이 초 미세화 됨으로써 이는 생산수율과 직결되는 오염제어 관리가 더욱 심화되어 반도체 부품의 초정밀 세정이 요구되며,
고가의 부품 구매 비용 및 관리를 위해 부품 손상의 최소화가 아닌, 각종 Parts의 Life Time 을 극도로 연장시킬 필요가 있습니다.
요약하면, 반도체 부품의 특성이 민감하고 초정밀 세정이 필요하기 때문에 반도체 산업은 공정청결을 유지하는 데 큰 어려움을 겪고 있습니다.
부품 수명을 연장하고 높은 생산 수율을 확보하기 위해서는 오염 물질 제거와 재료 무결성(Material Integrity) 유지의 균형을 맞추는 것이 중요합니다.
반도체 제조의 변화하는 요구를 충족시키기 위해서는 공정의 지속적인 발전과 더불어 초정밀 세정 기술의 도입이 필수적입니다.

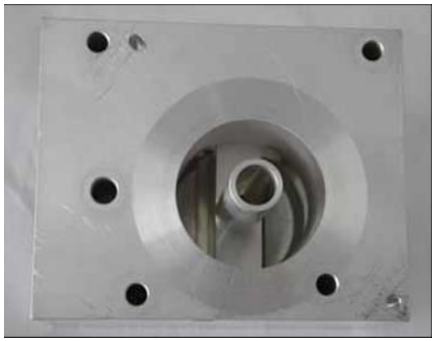
SKP의 정밀화학약품 (Fine Chemical) 의 보유기술은 수년전에 다양한 검증을 거친 후 일본의 Sony Semiconductor (규슈 소재) 에서 기술 도입하여 In House Cleaning (部品 洗淨 內在化) 을 시행하여, parts 구매비용 절감과 더불어 외주비용, 배송, 재고 관리의 문제를 해결하였습니다.
최근에는 반도체 공정의 요구에 부합하는 초정밀 세정을 위한 정밀화학약품으로 Up-Grade 되었습니다.
SKP fine chemical 의 특징 : Damage free , High Selectivity , Eco-friendly, No use HF, HNO3, HCl , NH4OH
첨부 파일 (attached file) : 소니 반도체의 부품세정 내재화 Data (Evaluation Reports of Semiconductor Parts Cleaning)

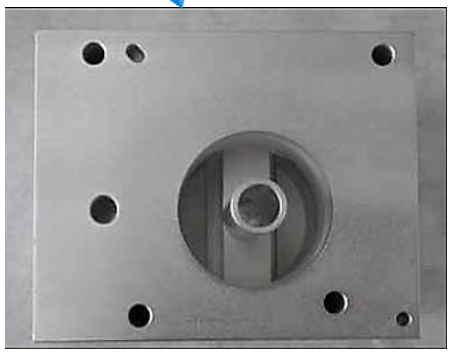
Aluminum Parts Cleaning

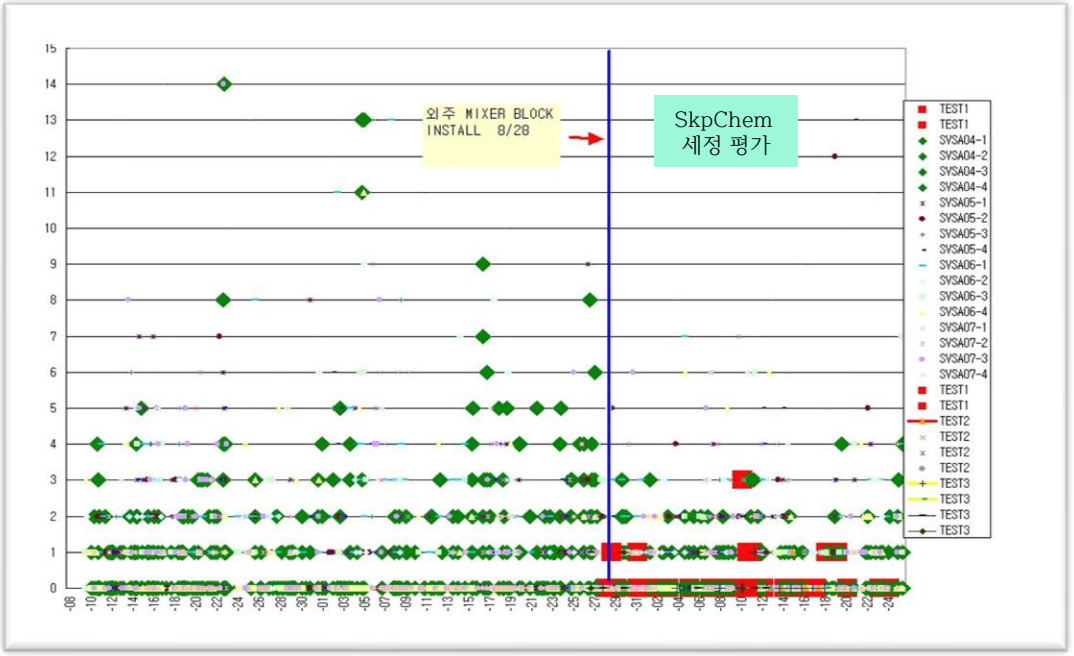
● Mixing Block Cleaning DATA

Equip	GIGAFILLA	Process	CVD(HT USG)	Depo' material	
Parts	MIXING BLOCK	Materials	Al	Manufacturer	A.M.A.T

☞ Result : Other's : Stopping the production line in every 2,000 sheet produce.
New Cleaner : Stopping in every 4,500 sheet. Due to drastic reduce of particles, The yield improved much.





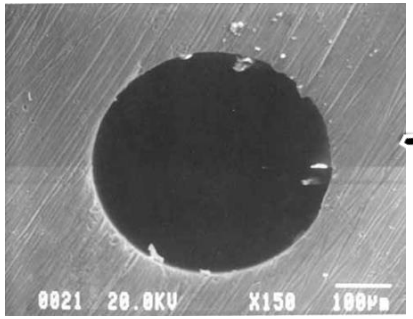


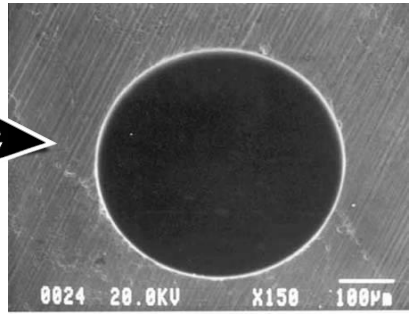
■ Install TEST - 1st : 1EA installed to SVSA04 CHAMBER C. WET CLN in 4,550 sheet .
- 2nd : 3EA installed to SVSA05 CHAMBER B. TEST 4,289 sht. WET CLN
SVSA05 CHAMBER D PM as Blade broken at 4,451 sheet.
SVSA06 CHAMBER A WET CLN at 3,300 sheet.

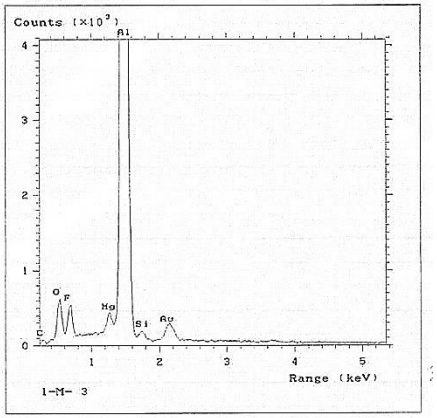
■ Comparison : Equip: SVSA04 BIN1: MIXER BLOCK .CLN
Before install: (av. 07:09) : 1.058 EA After install : (in av. 28 - 9/25): 0.32 EA

Aluminum Parts Cleaning

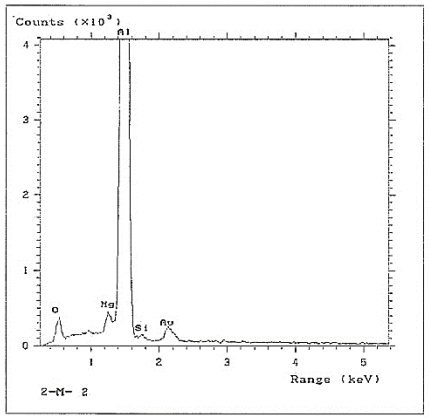
Shower Head (1) Cleaning



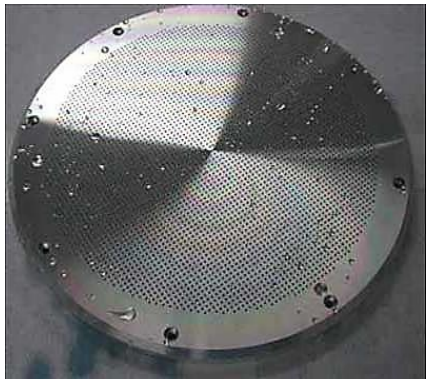




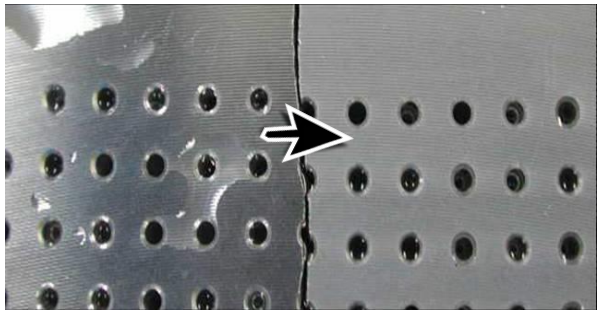
Depo' material : AlF3 , Al2O3



Cleaning out Depo' material

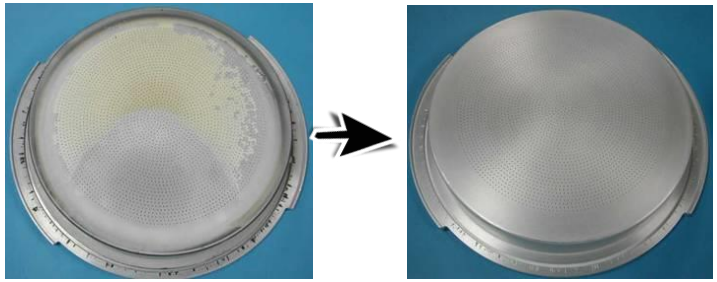


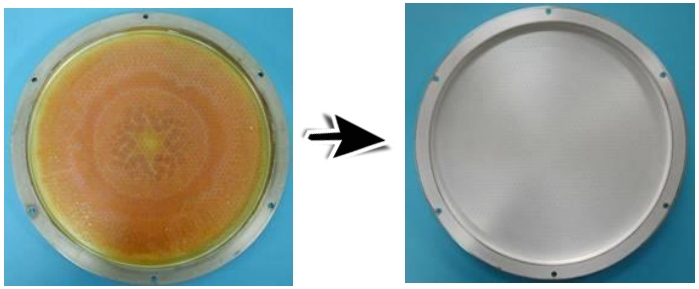
△ water break (hydrophobic)

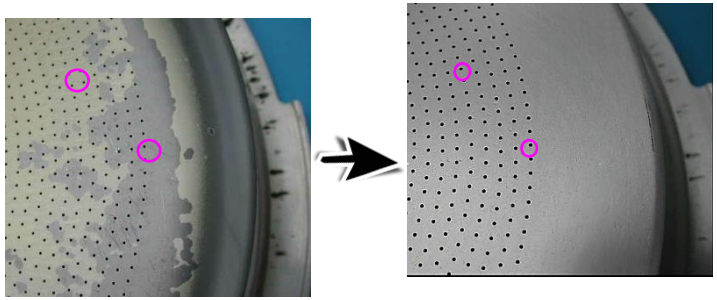


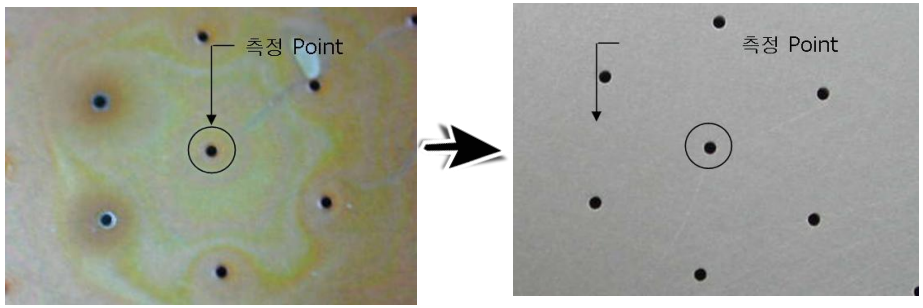
△ Non water break (hydrophilic)

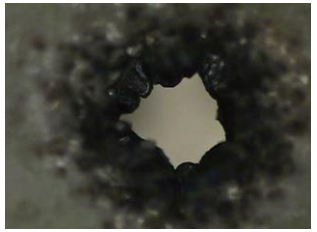
- Shower Head (2) Cleaning

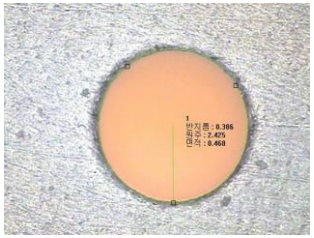


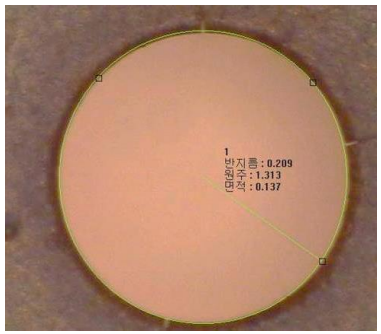


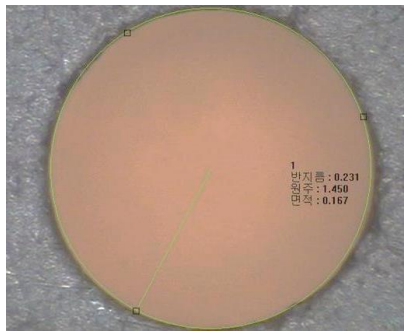


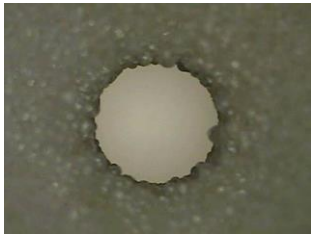


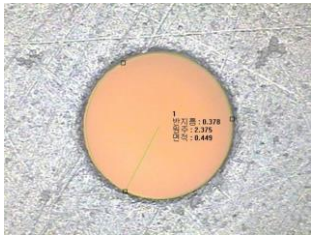






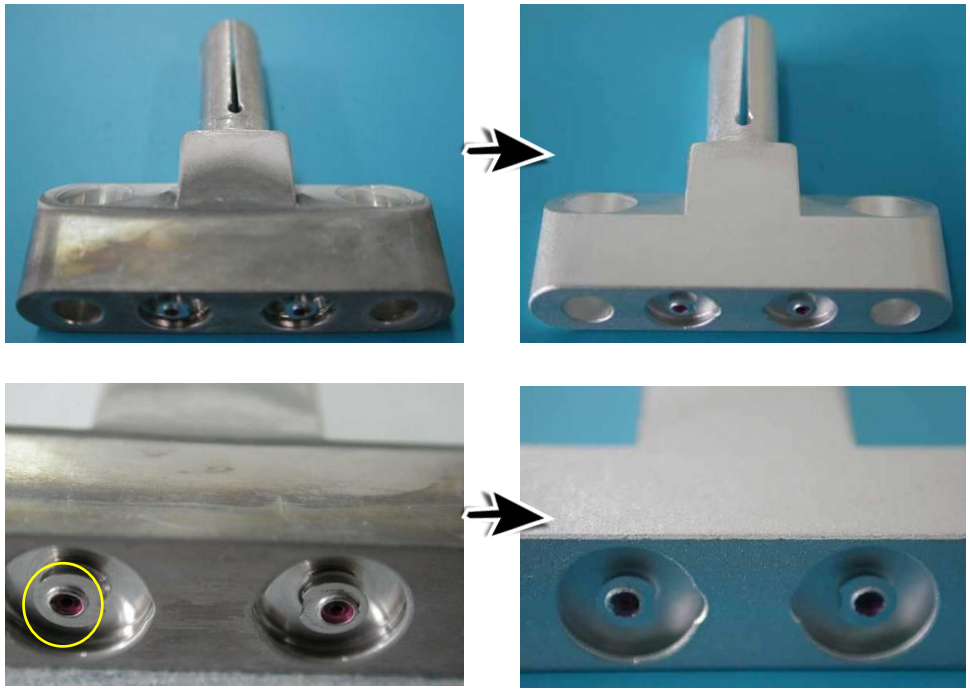




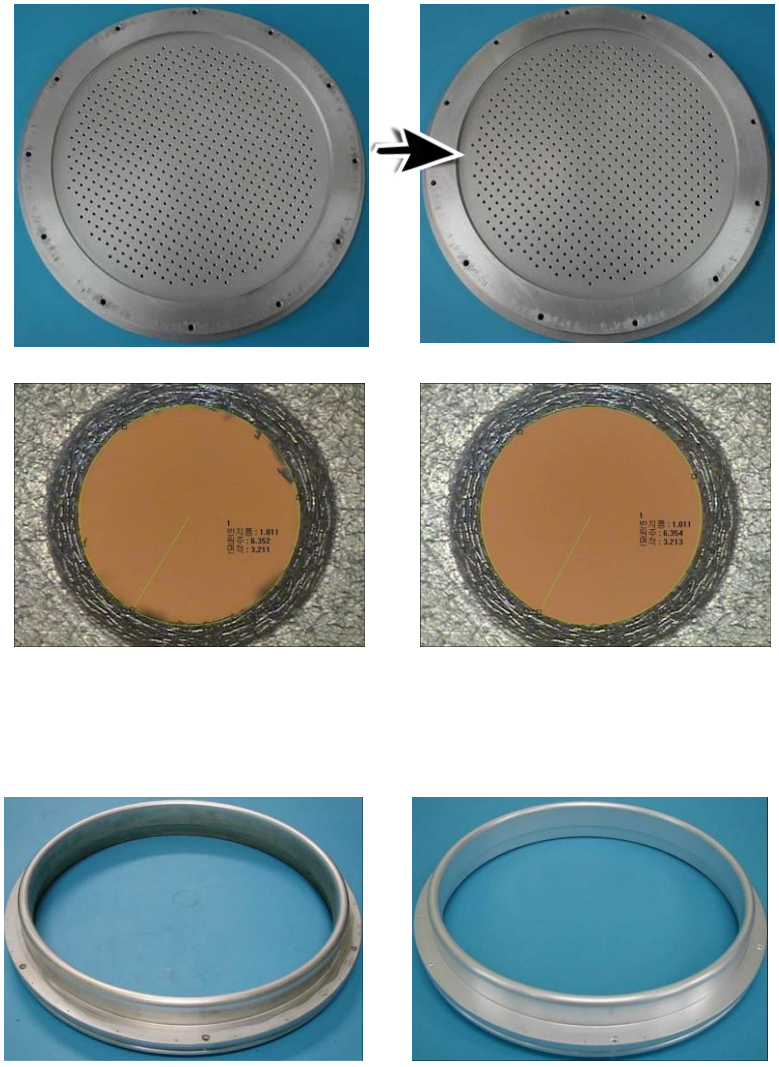


Aluminum Parts Cleaning

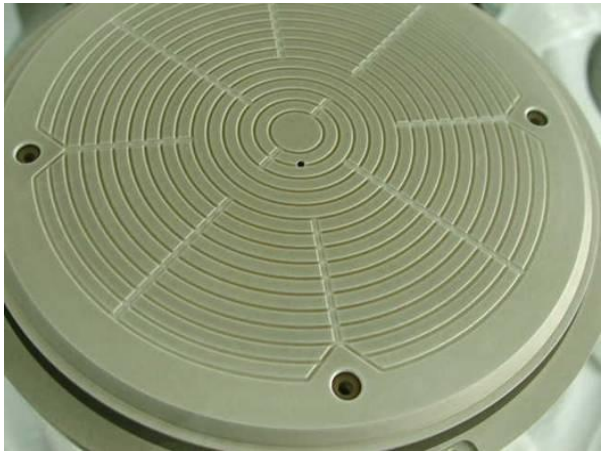
Sapphire Nozzle Cleaning

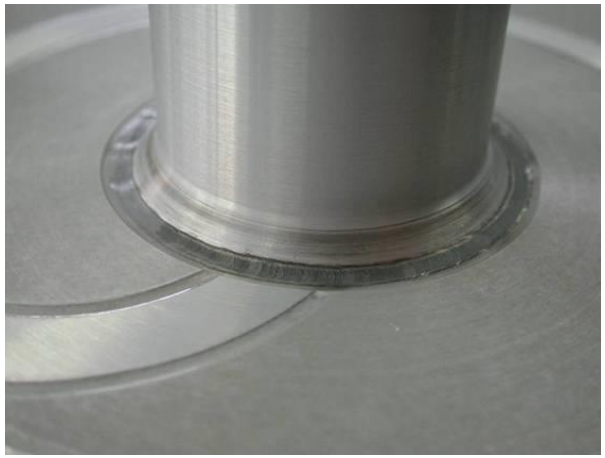


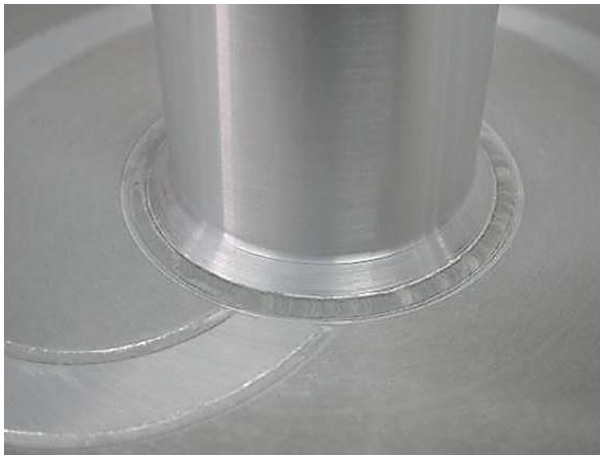
Cooling Plate



- WXZ Heater Cleaning

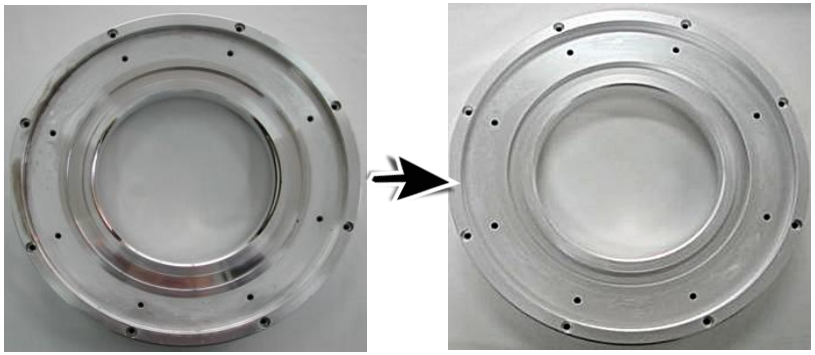




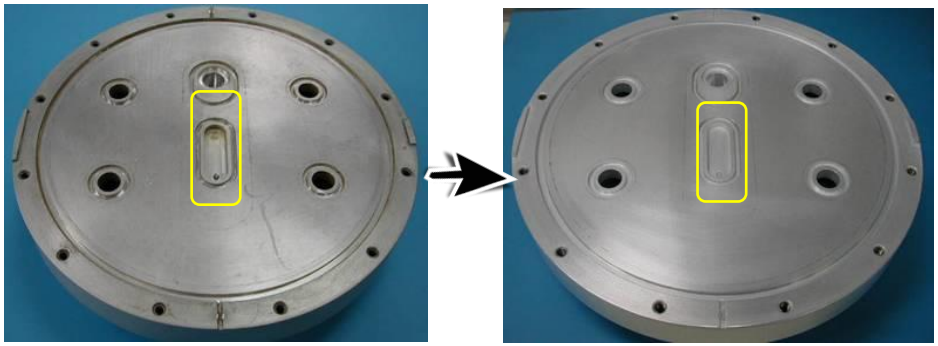


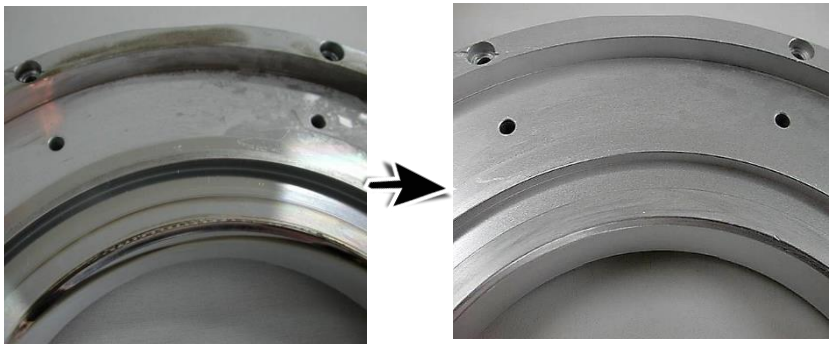
Aluminum Parts Cleaning

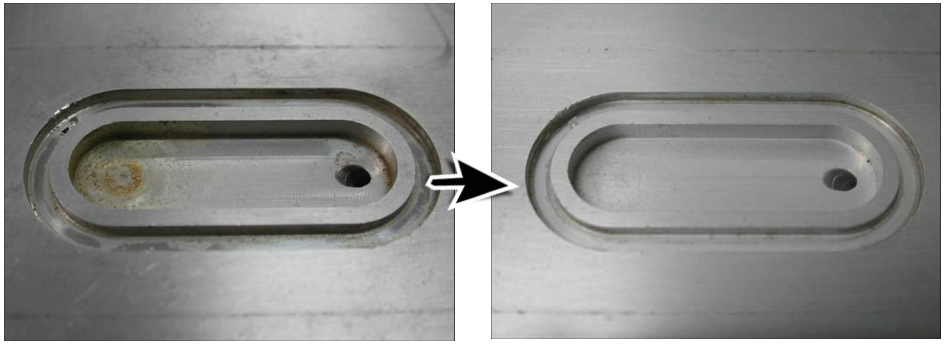
- Bell Jar Plate Cleaning



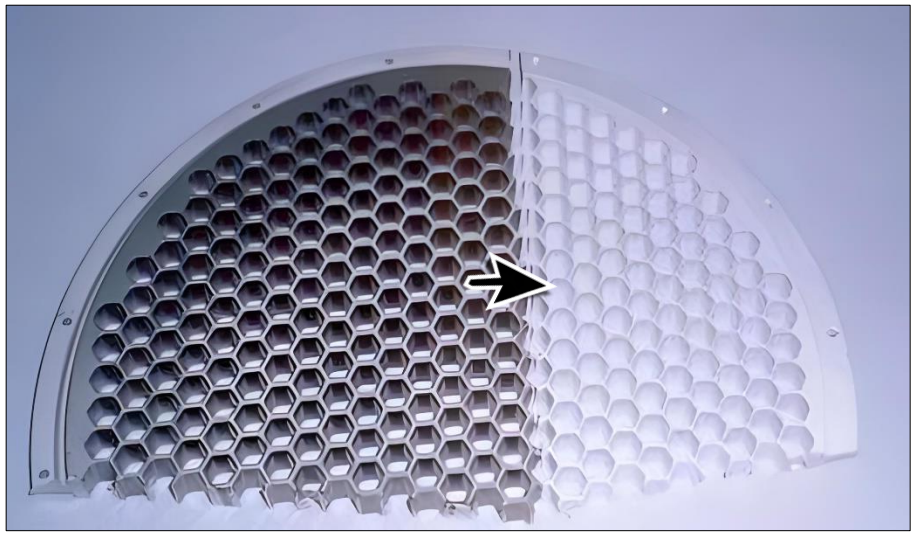
- Cathode Stage Cleaning

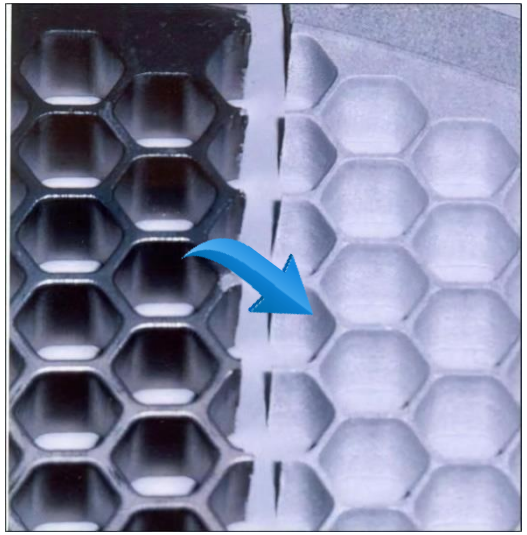


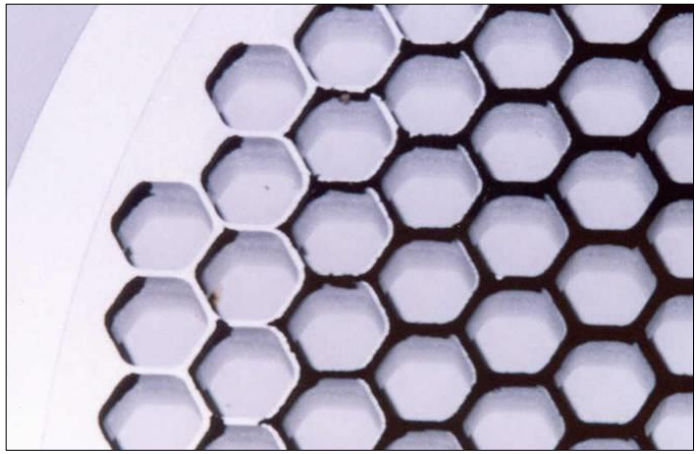




- Collimator (TiN Depo) Cleaning

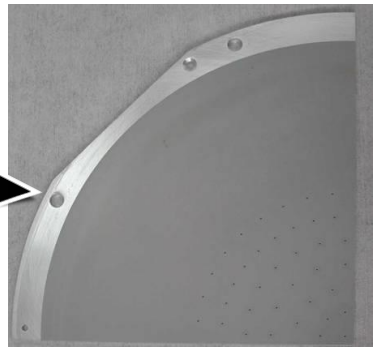


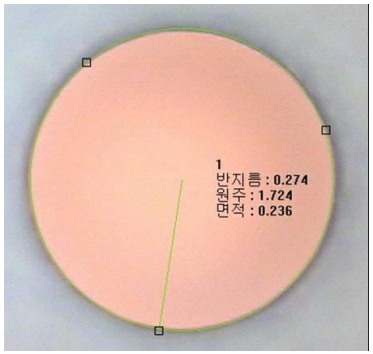


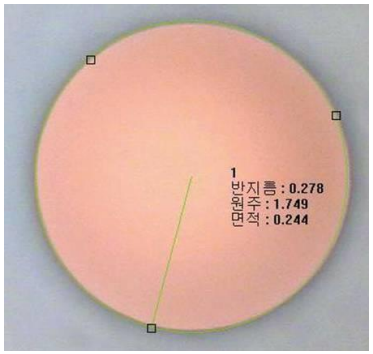


Anodized Aluminum parts Cleaning

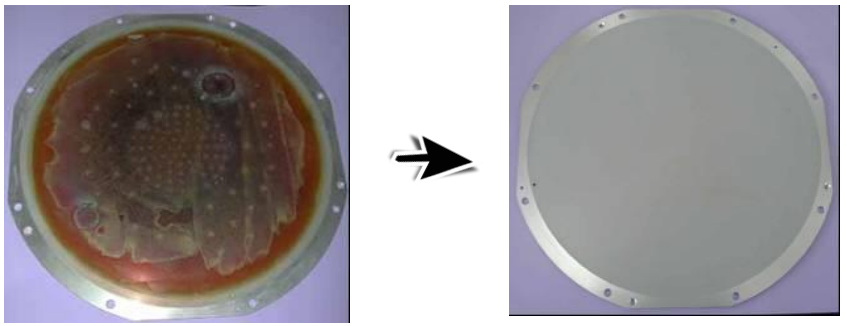
Oxide Etch GDP Cleaning

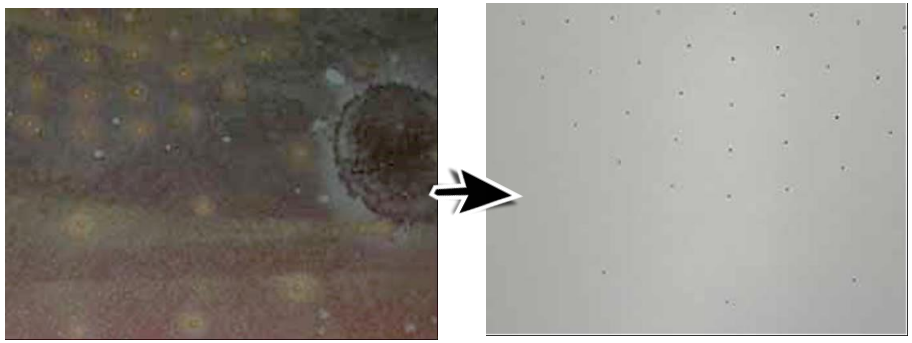


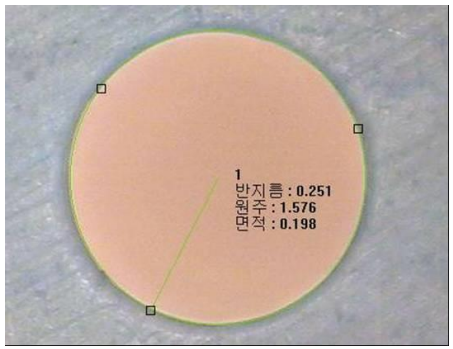


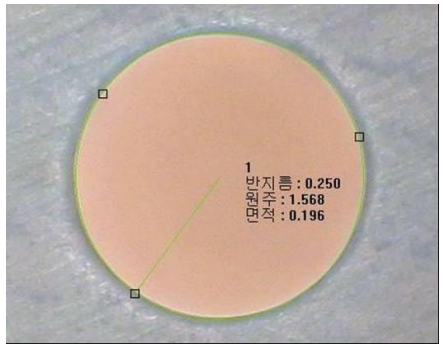


Metal Etch GDP Cleaning



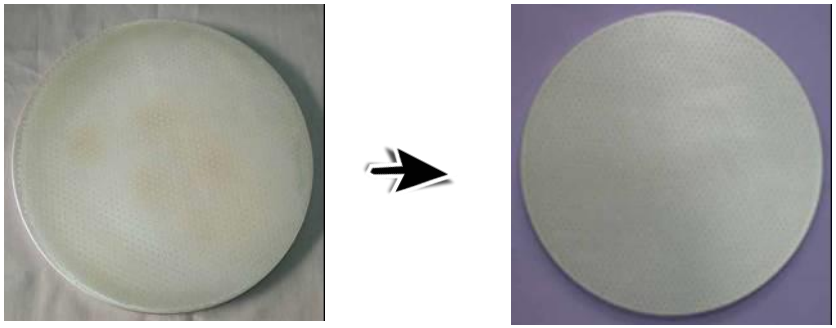


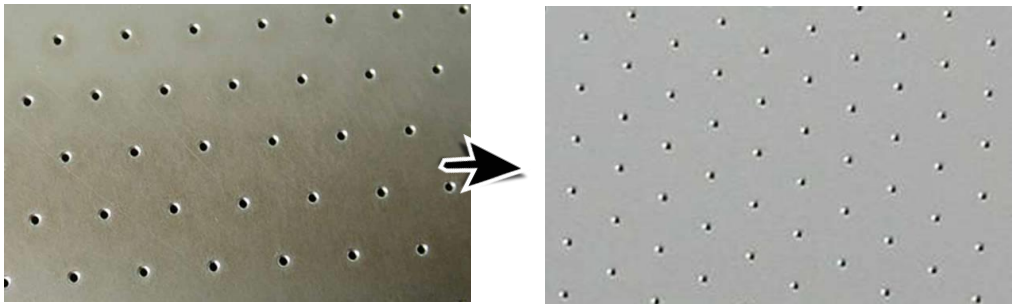


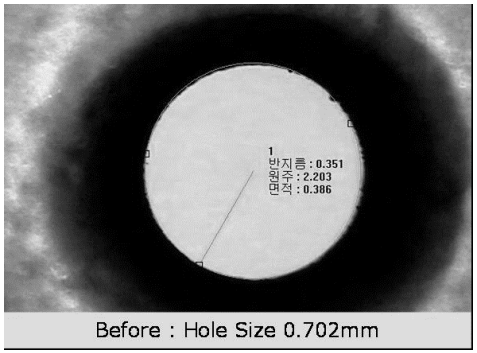


Anodized Aluminum parts Cleaning

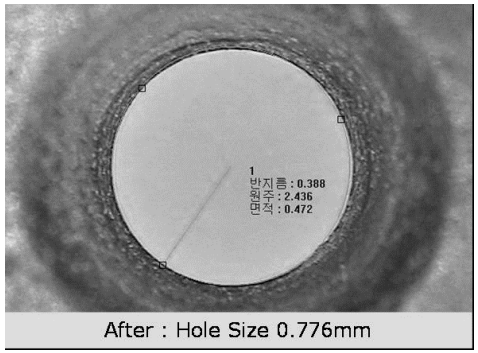
Metal Shower Head Cleaning







Before : Hole Size 0.702mm

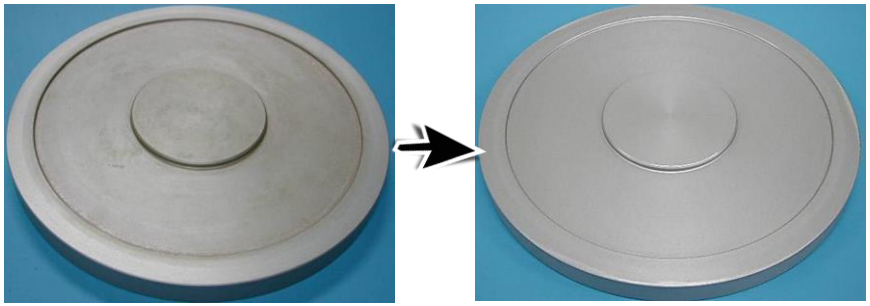


After : Hole Size 0.776mm

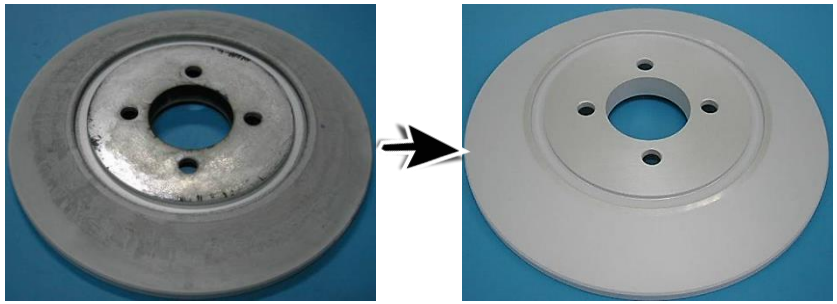
T/V Cover Cleaning

Anodized Aluminum parts Cleaning

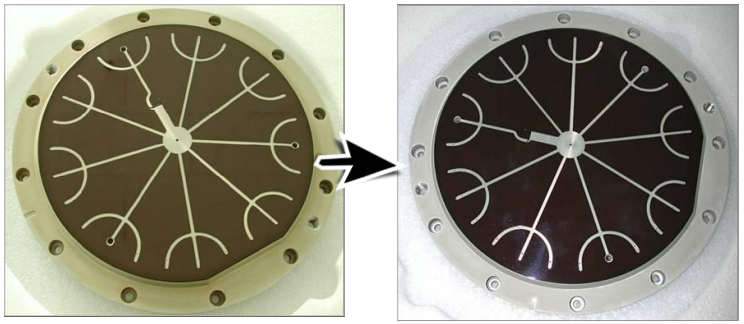
- G/V Cover

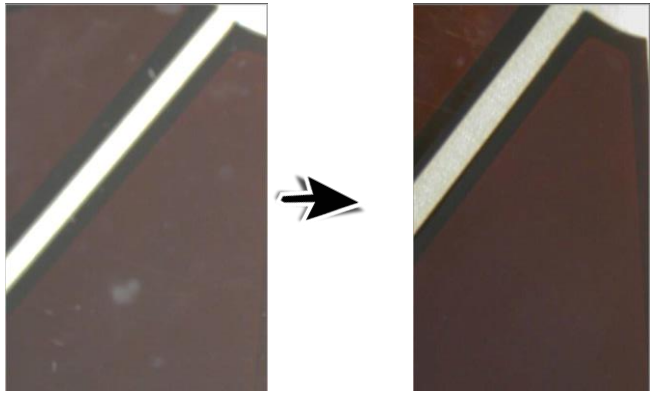


- Ashing stage

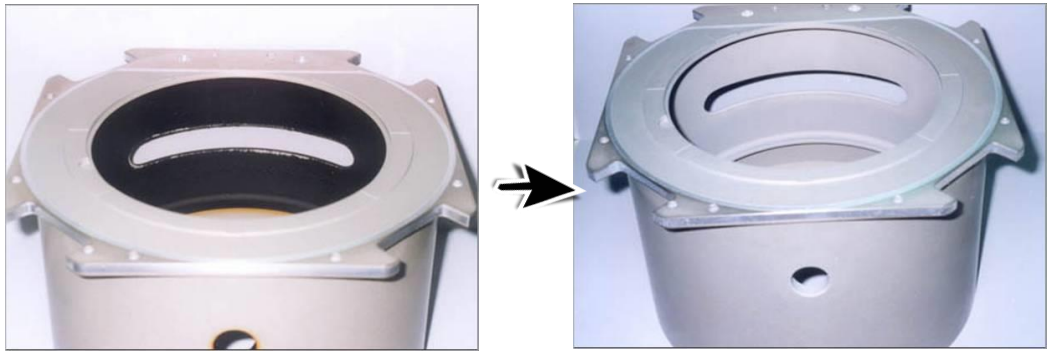


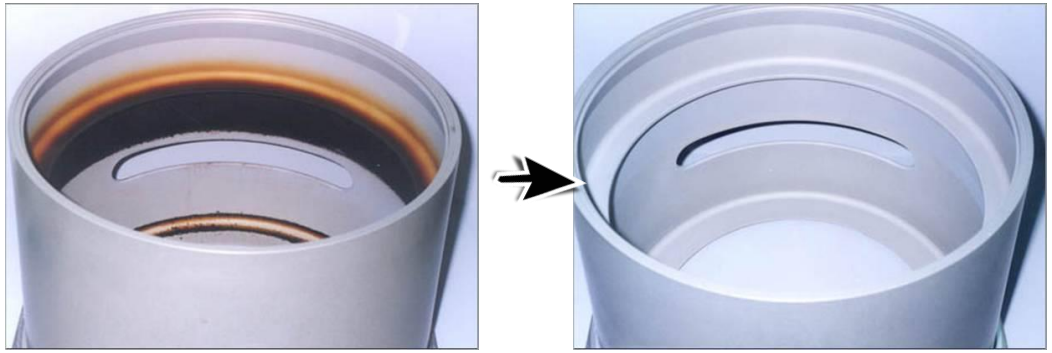
- PDS+ ESC Cleaning





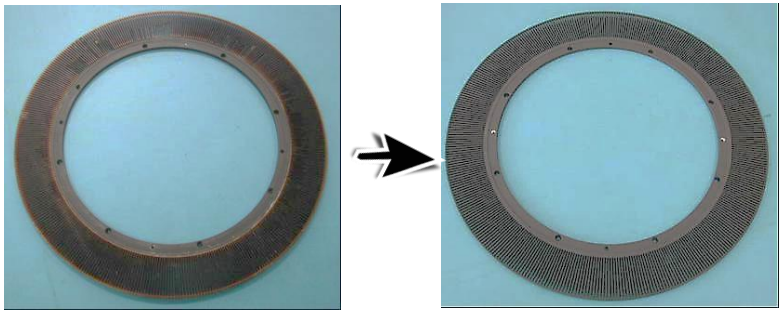
- Al Liner Cleaning

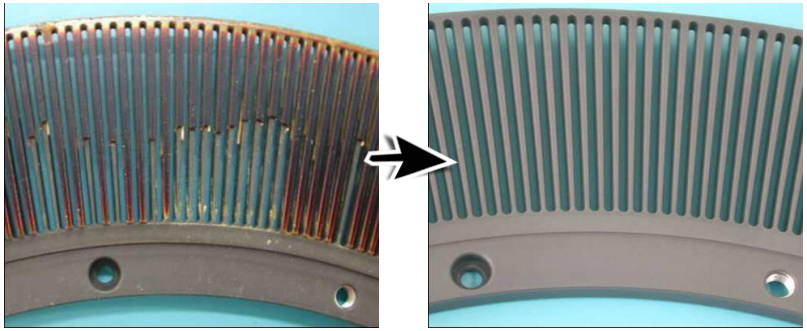




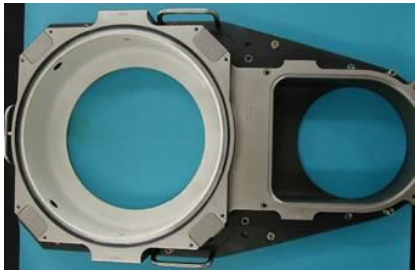
Anodized Aluminum parts Cleaning

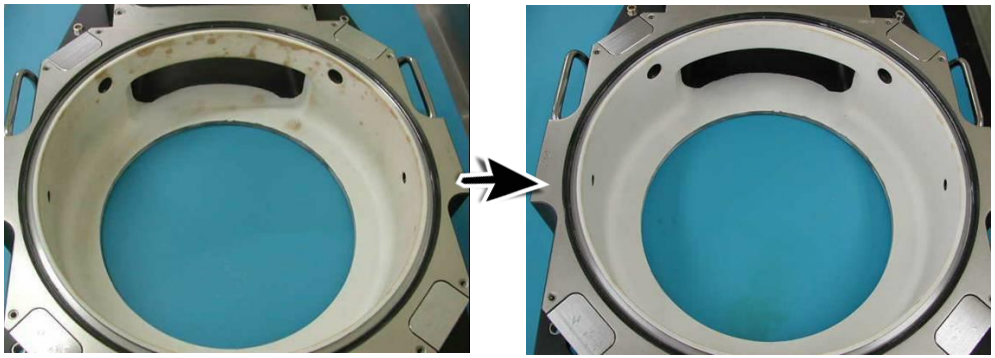
- Baffle Cleaning

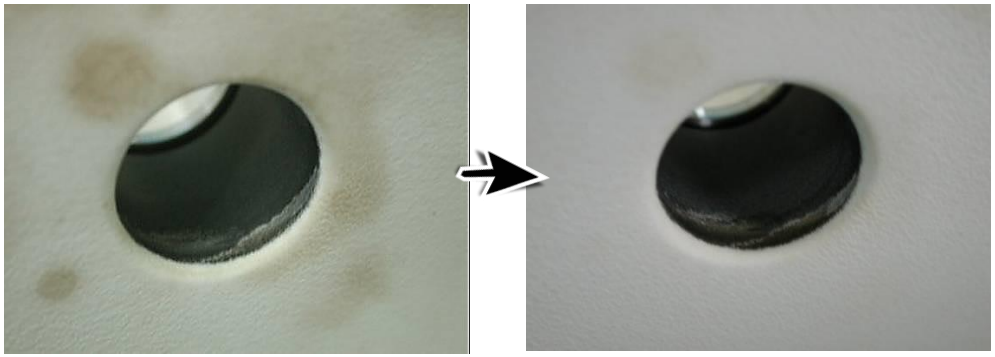




- Yttria (Y2O3) coated Chamber

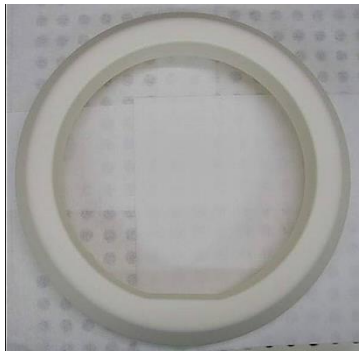


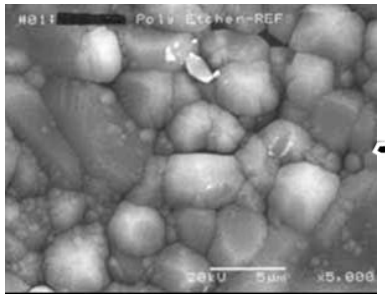




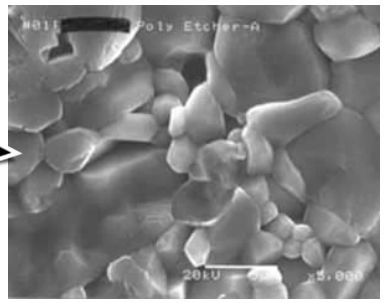
Ceramic Parts Cleaning

Capture Ring Cleaning

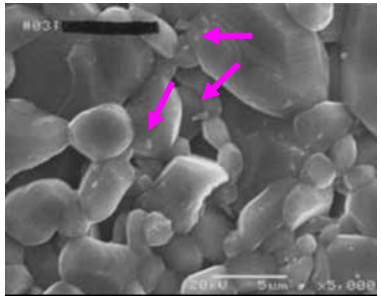




△ Before Cleaning

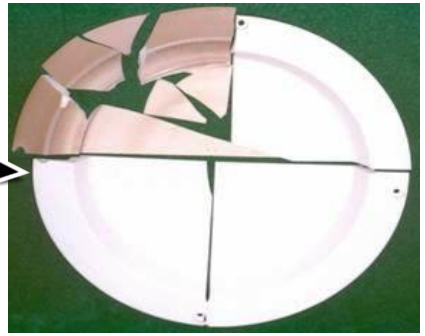


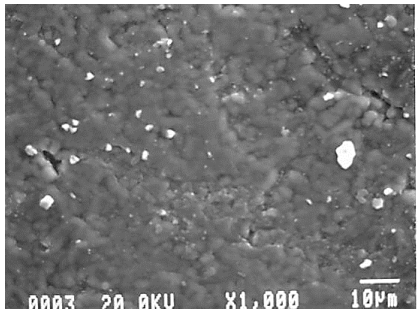
△ After cleaning
(New Chemical)

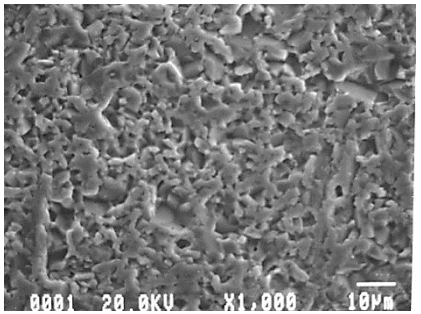


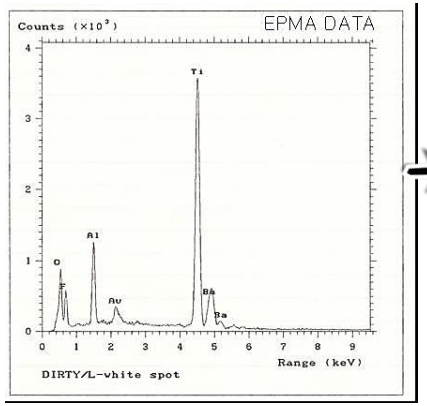
△ After cleaning (Conventional : Particle Remained)

Shower Head Cleaning

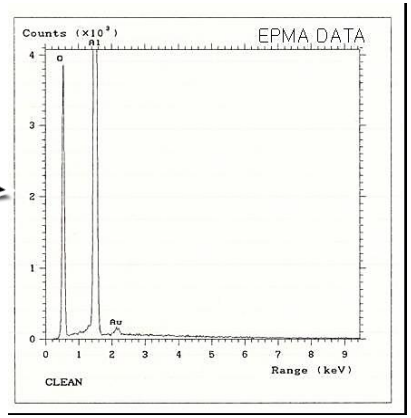






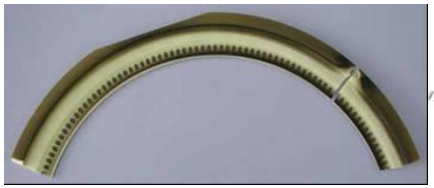


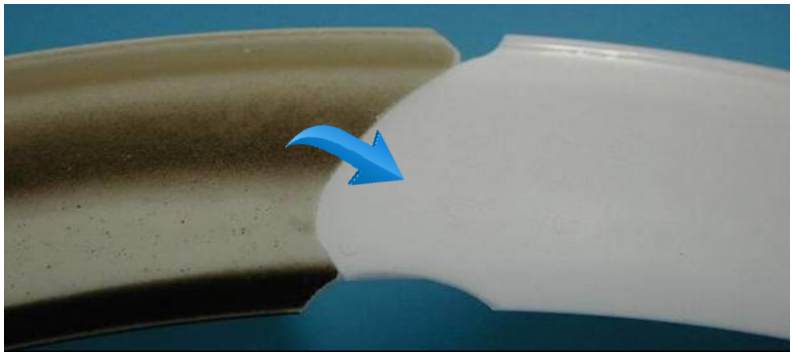
Depo' material : AlF3 , TiO2

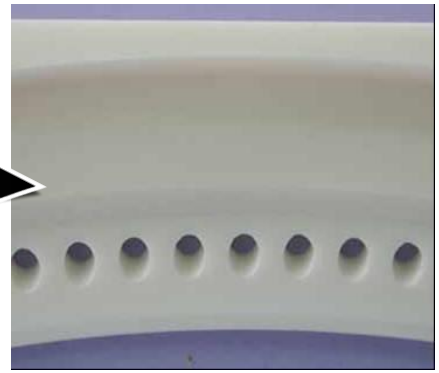


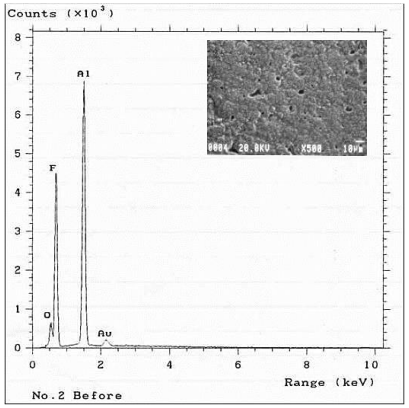
Cleaning out Depo' material
(Only Al2O3 peak)

Edge Ring Cleaning

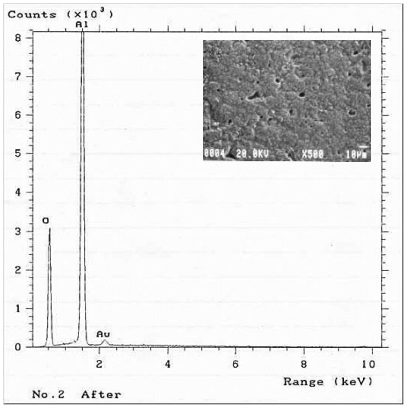




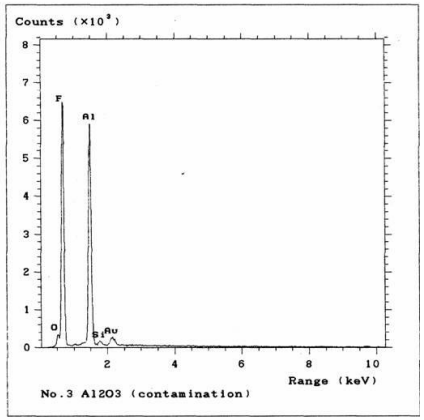




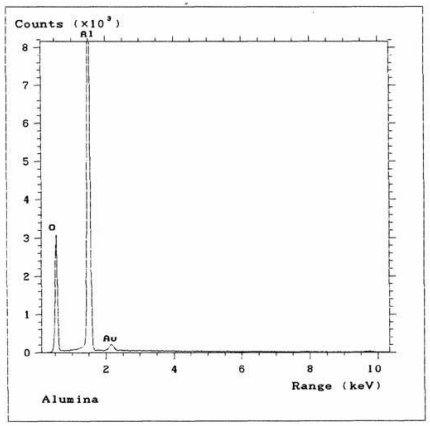
Depo' material : Fluorine



Cleaning out Depo' material
(Only Al2O3 peak)

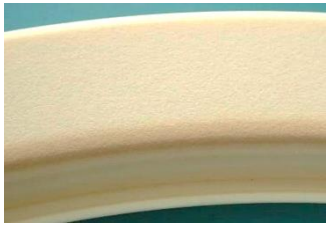


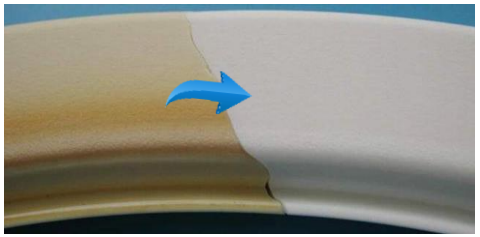
Depo' material : Fluorine

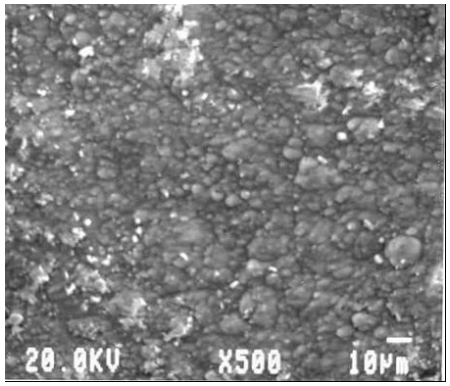


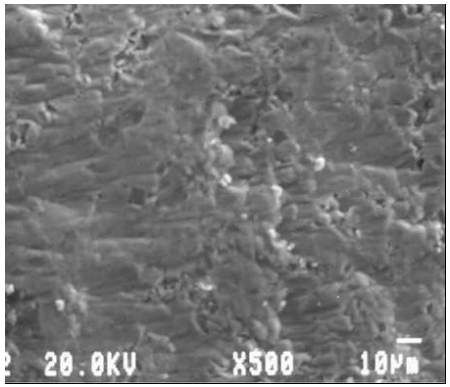
Cleaning out Depo' material
(Only Al2O3 peak)

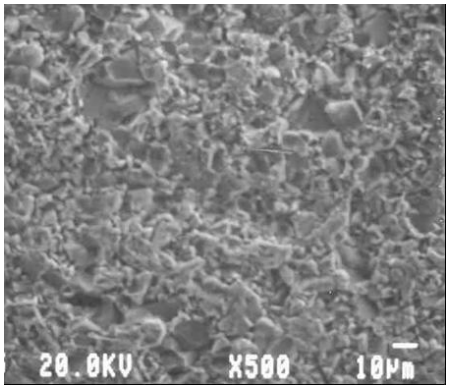
Capture Ring Cleaning

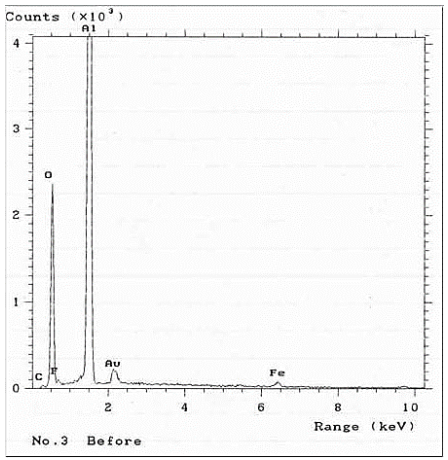




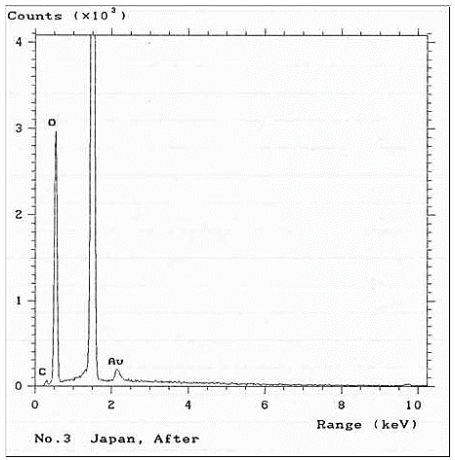




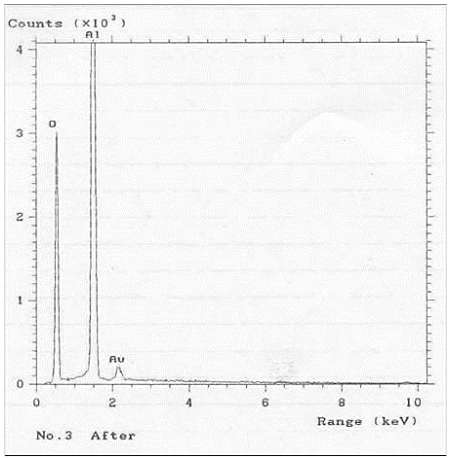




Depo' material : Fluorine, Carbon



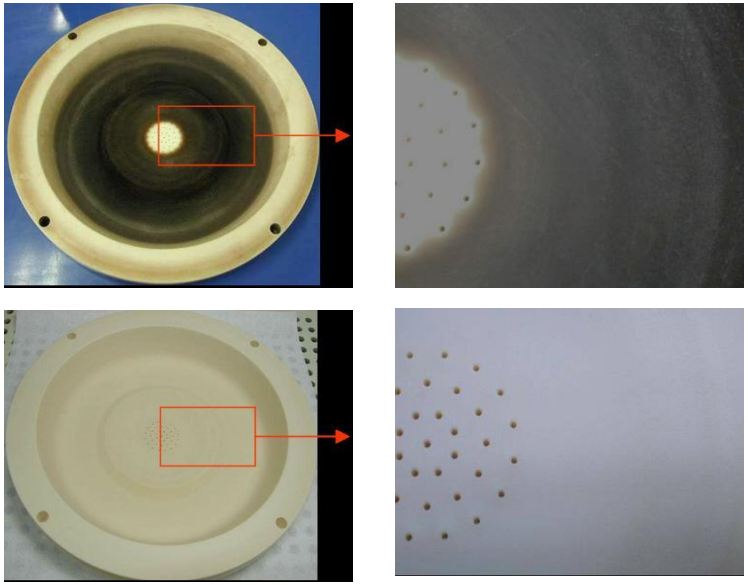
Depo' material : Carbon
(conventional)



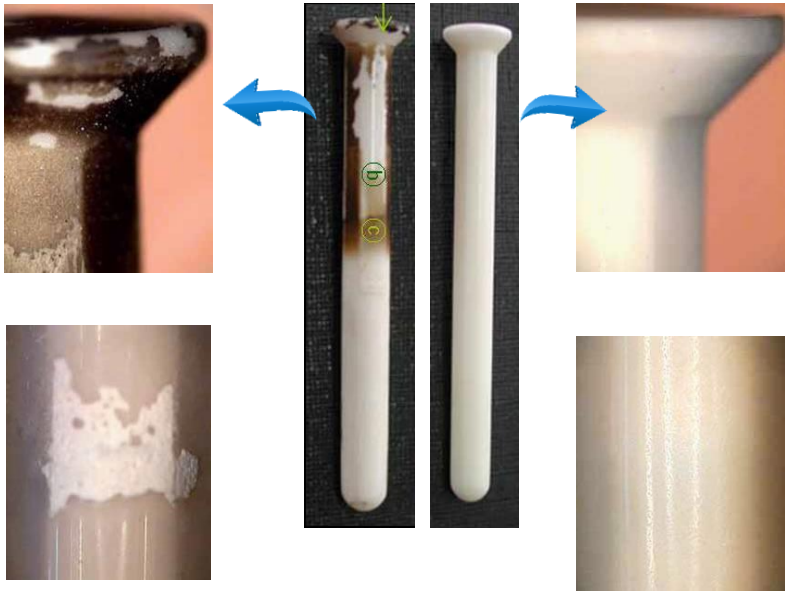
Cleaning out Depo' material
(New Chemical Only Al2O3 peak)

Ceramic Parts Cleaning

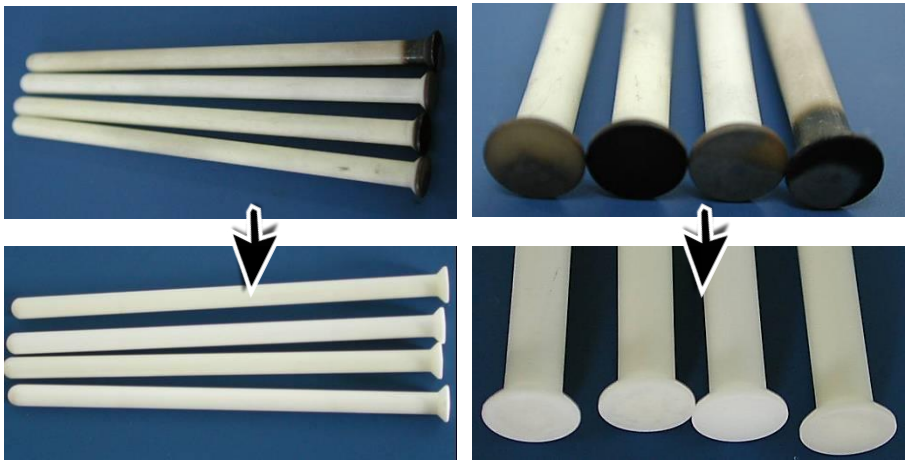
Shaped window



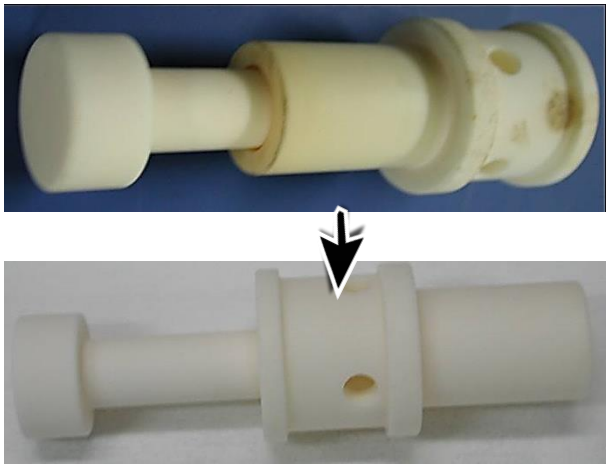
Clamp Pin



Lift Pin

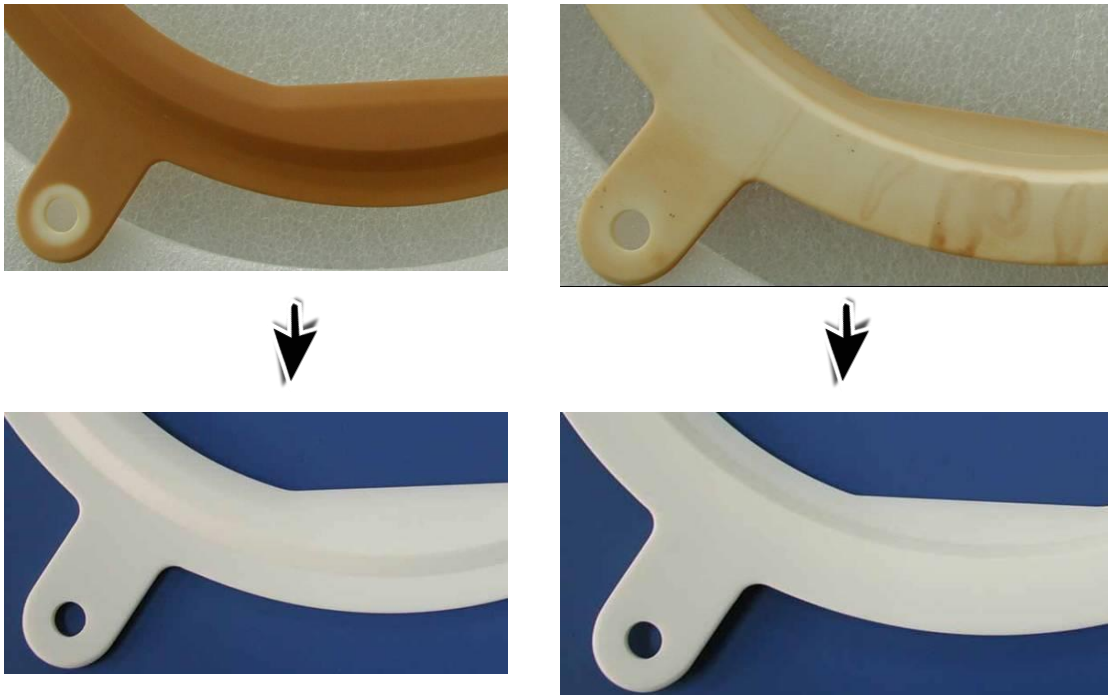


Injection Nozzle

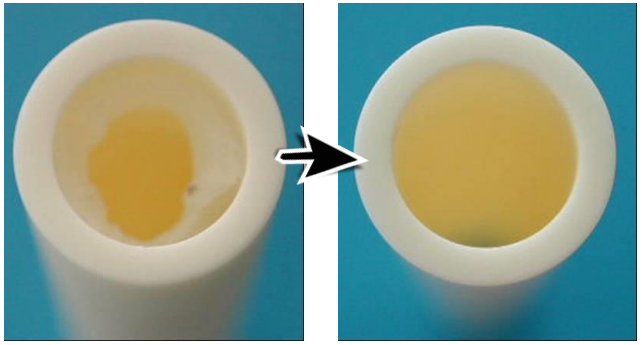


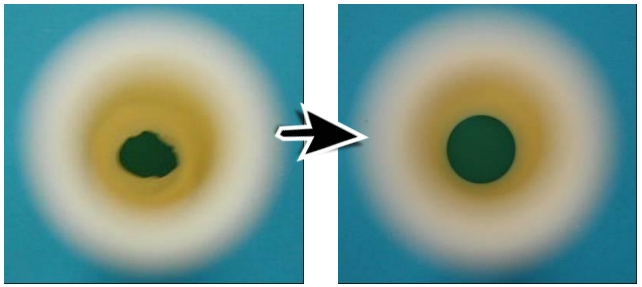
Ceramic Parts Cleaning

- Clamp Ring



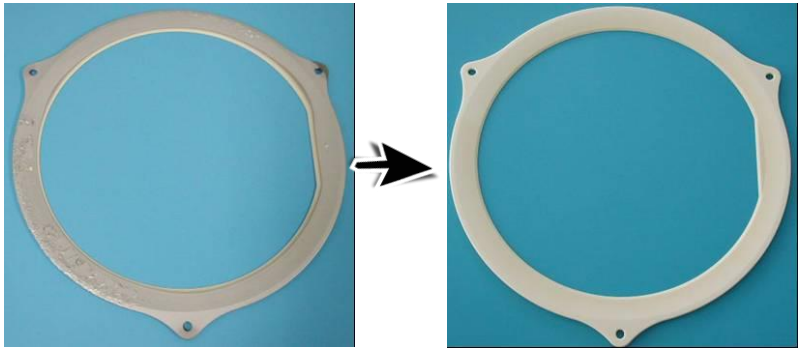
- Injector Hole



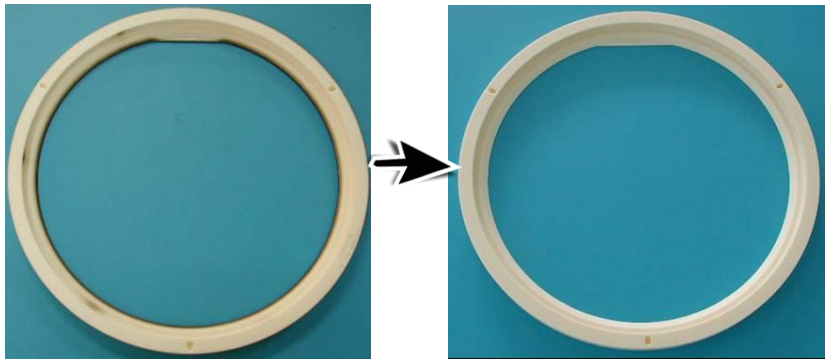


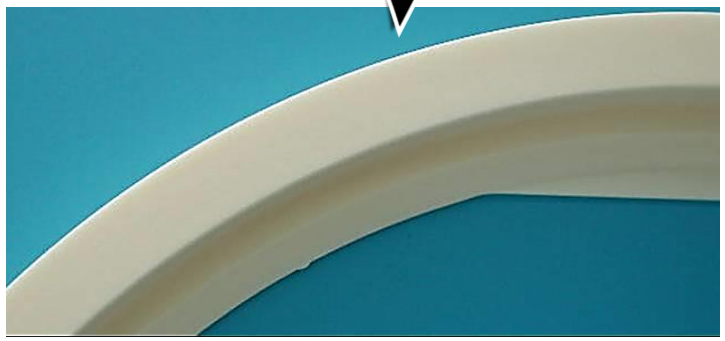
Ceramic Parts Cleaning

- Inner Shadow Ring



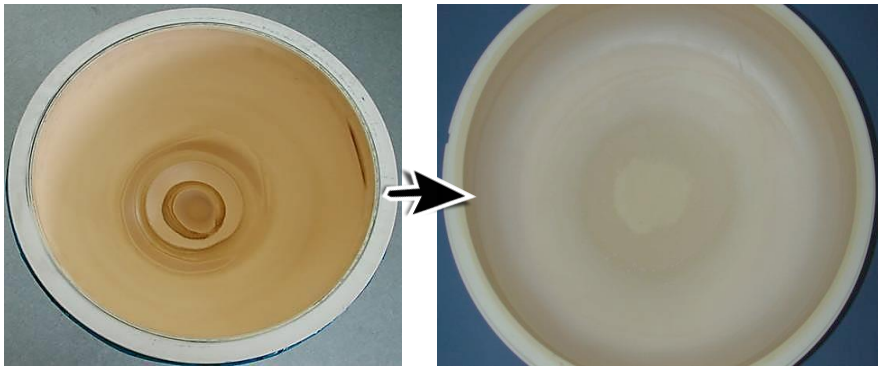
- Purge Ring

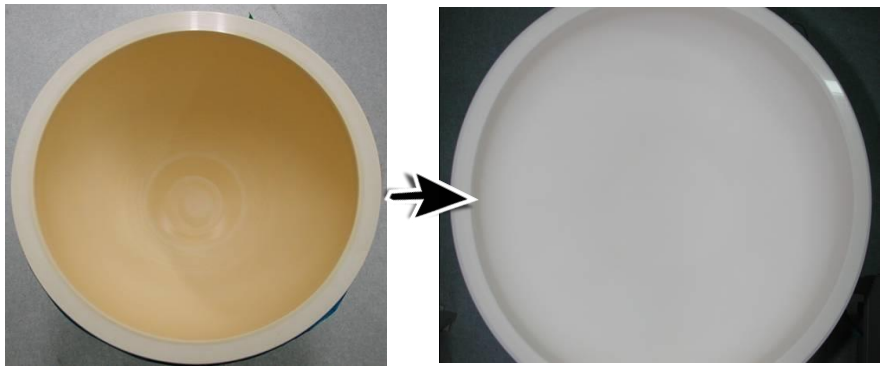




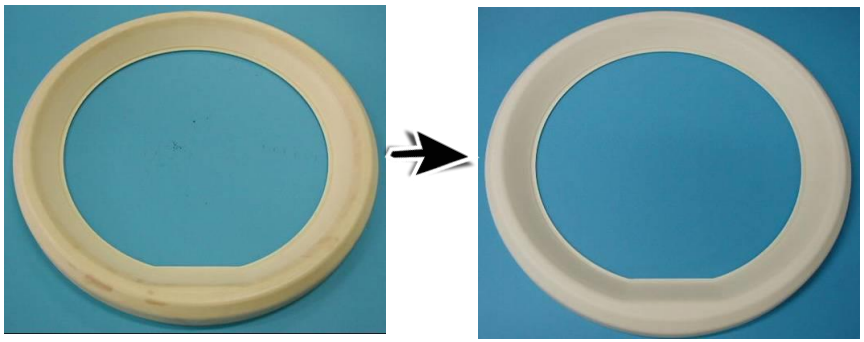
Ceramic Parts Cleaning

- Ceramic Dome

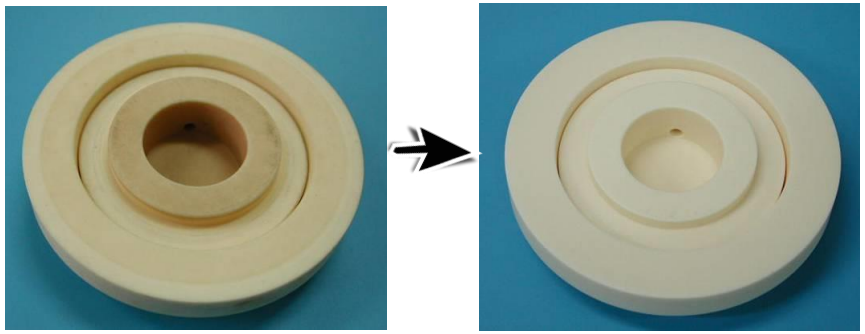




- Focus Ring



- Ceramic In /Out

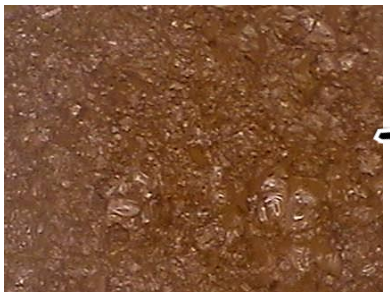
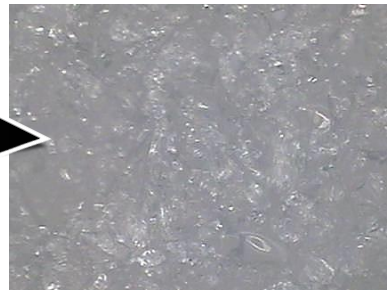


Quartz Bell Jar Cleaning Data

Equip	E-5500	Process	SPUTTER (OXIDE ETCH)	Depo' material	POLYMER
Part	BELL JAR	Material	QUARTZ	Manufacturer	A.M.A.T

☞ Result : Other's : Frequent PM due to heavy particles.
New Chemical : Drastic reduce of PM.



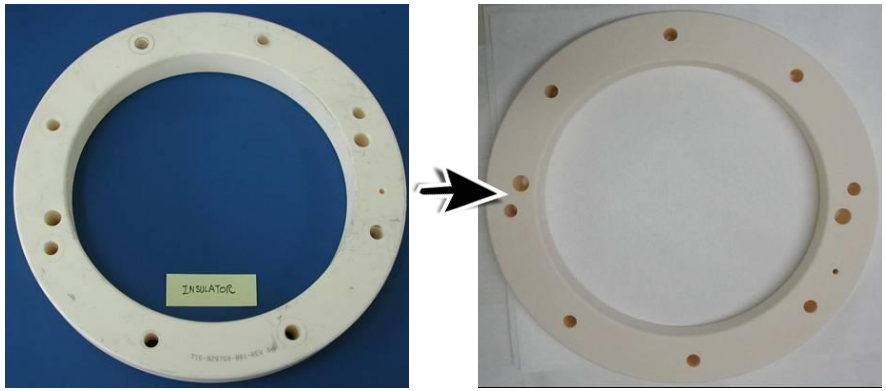



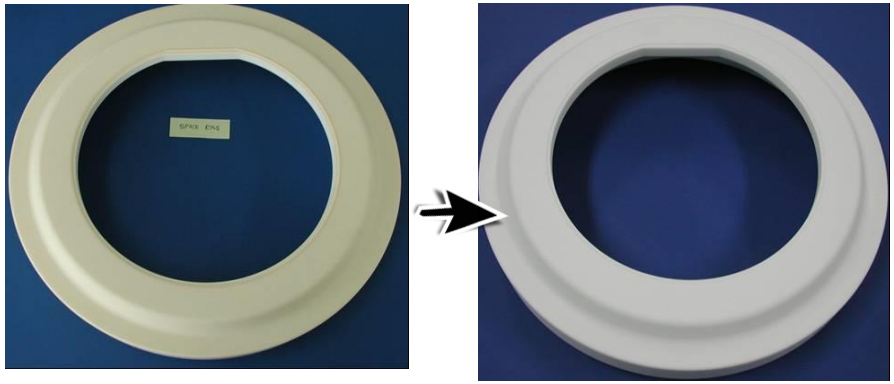
DATE	CH:C						CH:D					
	THK	P/T	MOVE	Time	Usage	REMARK	THK	P/T	MOVE	Time	Usage	REMARK
1/2	403	2										
1/4					S/C - 1469장		402	9	4			RUN
1/7							389	0		52	916	
1/9	385	7	50	53.5								
1/9		11	6			RUN					S/C - 1426장	
1/11	427	12		54.5		51"						
1/14	374	19		52.5			*E:320->0->0. F:1					
1/16	403	24	5			RUN						
1/16		3										
1/19					S/C - 1451장		402	3	4	52.5		RUN
1/21							375	3		54.5		
1/23	389	0	4	55.5		RUN					S/C RUN상 P/T多PM	
1/25	405	3			689							
1/28	396	16										
1/29					S/C - 1465장		415	17	4	55		53" RUN
2/1							406	12		53		52"
2/3	409	6	3	53		52" RUN					S/C - 1469장	
2/6	411	3		52	729							
2/8	398	5					394	7	0	53.5		
2/9								0				
2/11							413	2		55		
2/12	374	6	13	51		RUN					S/C RUN상 P/T多PM	
2/15	391	1										
2/18					S/C - 1496장		390	100	14			PURGE
2/18								100				
2/18	387	18	0			RUN					S/C P/T多 -- 재PM	
2/20	395	0										
2/22	393	2		53.5								
2/25					S/C - 1424장		413	95	5			PURGE
2/25							403	71				
2/25											S/C P/T多 -- 재PM	
2/25							391	66	5			
2/25								41				PURGE
2/25								67				
2/26	381	17	8	53.5		54.5 RUN					S/C P/T多 -- 재PM	
2/27	402	3				RUN						
3/1	386	0		54.5								
3/2					S/C - 1424장							

- P/T = particle CH=Chamber
- C Chamber : New Chemical applied
- D Chamber : Conventional

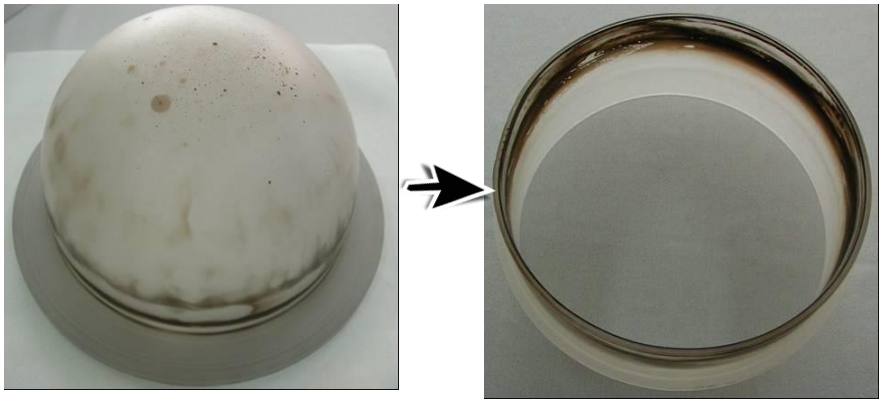
Ceramic Parts Cleaning

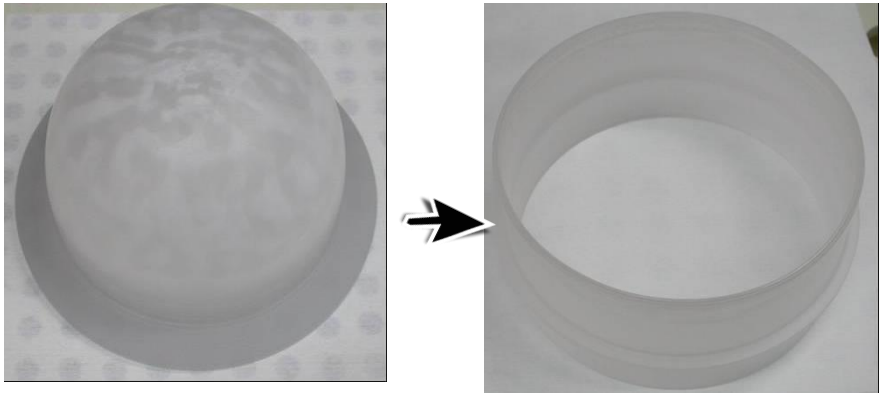
- Insulator / Space Ring



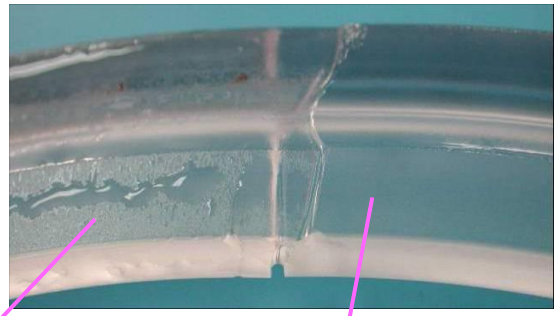


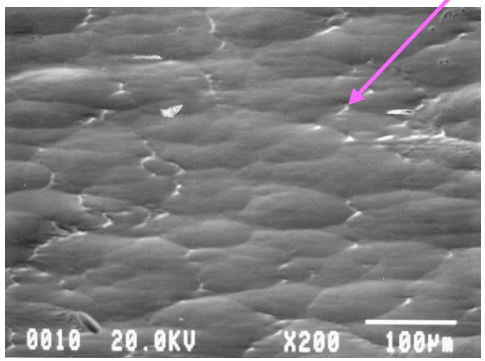
- Bell Jar / Ring

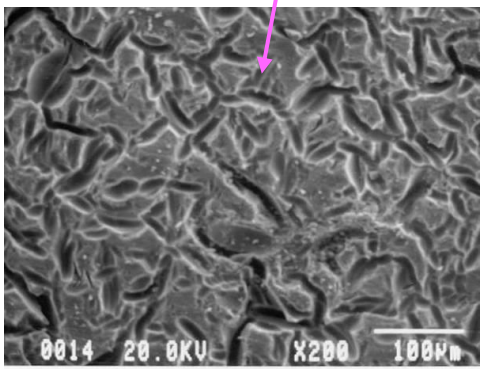


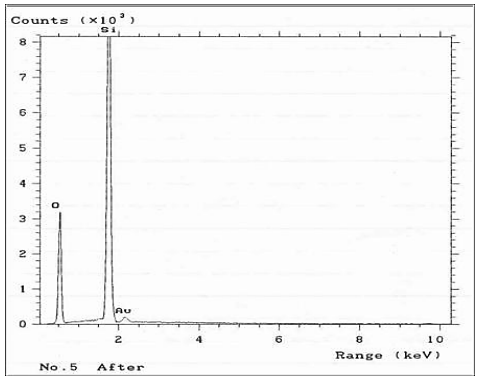


- Insulator Cleaning Data

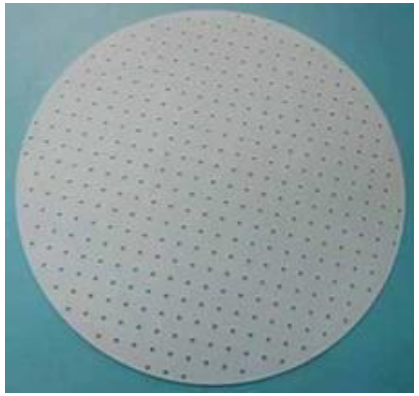


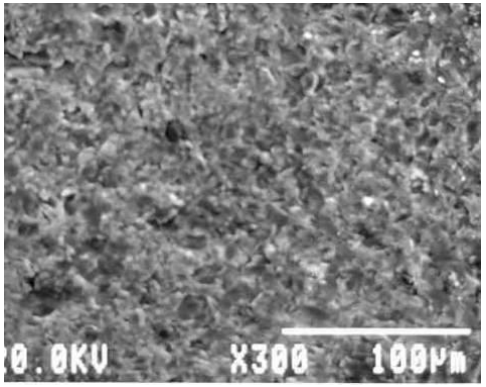


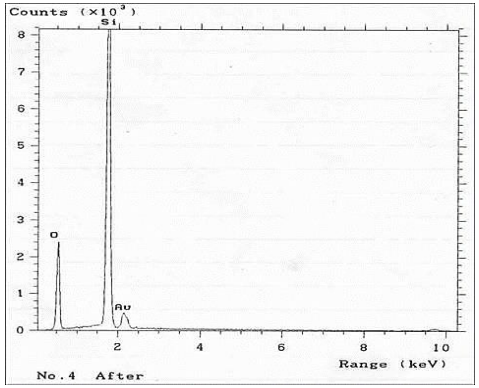




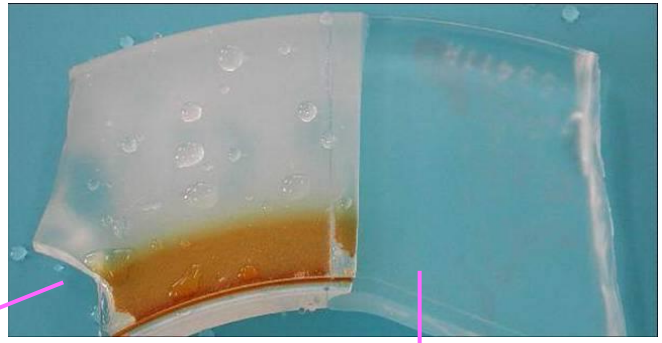
- GDP Cleaning Data

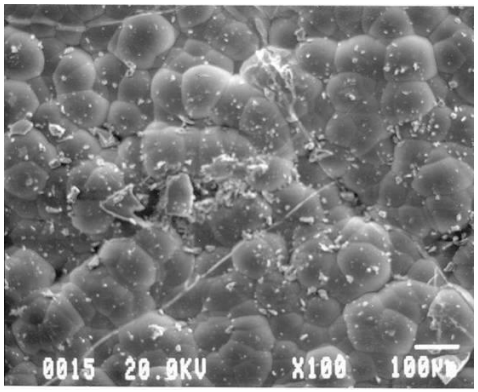


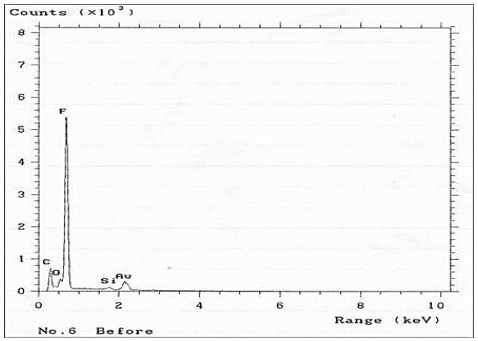




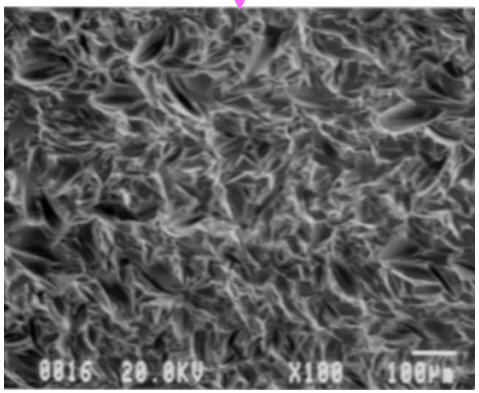
- Focus Ring (1) Cleaning data

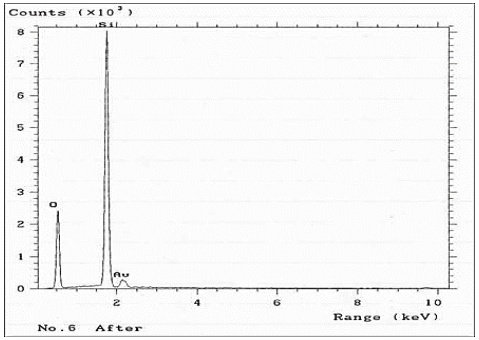






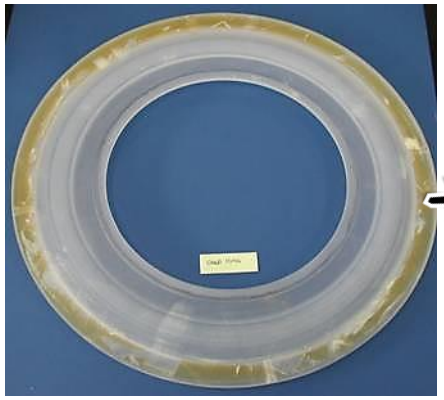
Depo' material : Fluorine, Carbon

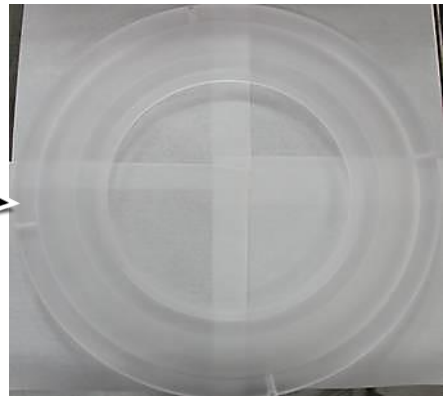


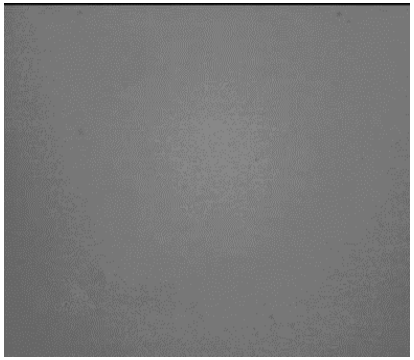


Cleaning out Depo' material
(New Chemical Only SiO2 peak)

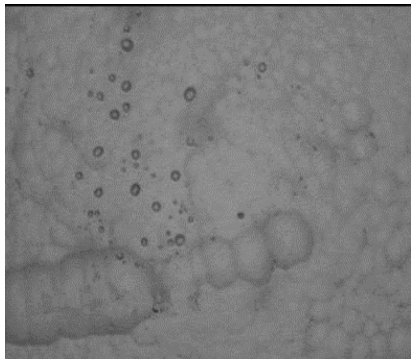
- Focus Ring (2) Cleaning



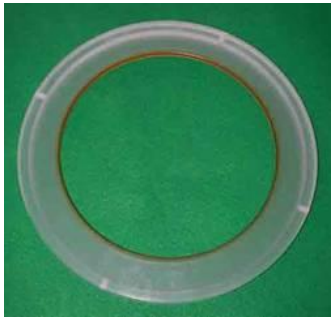


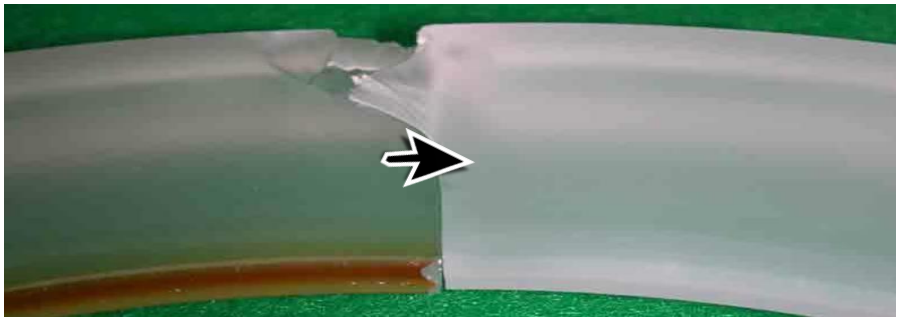


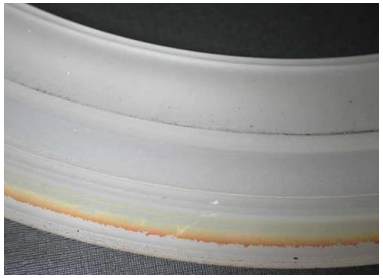
△ Damage free of New chemical



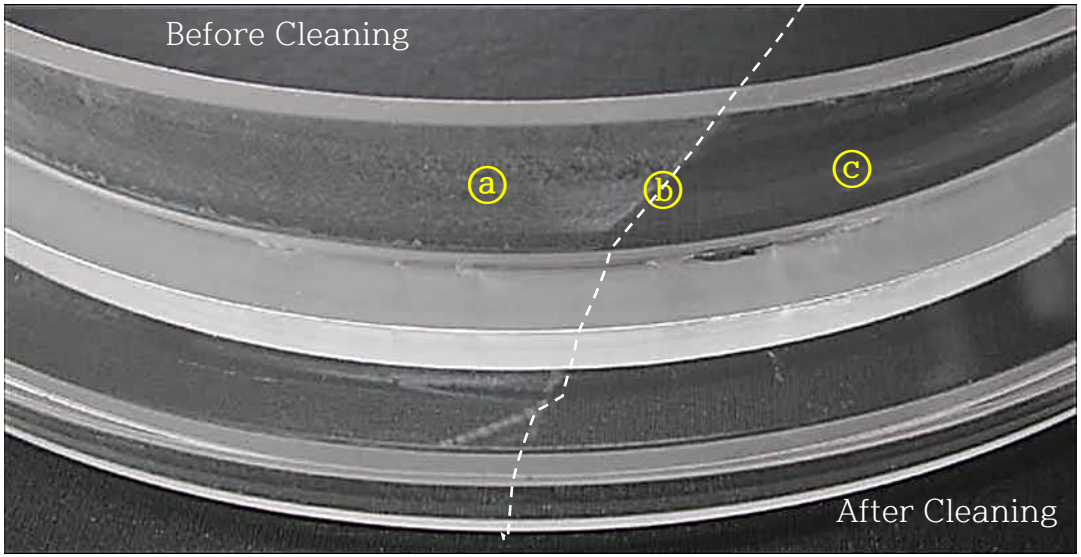
△ Surfaces damaged by HF

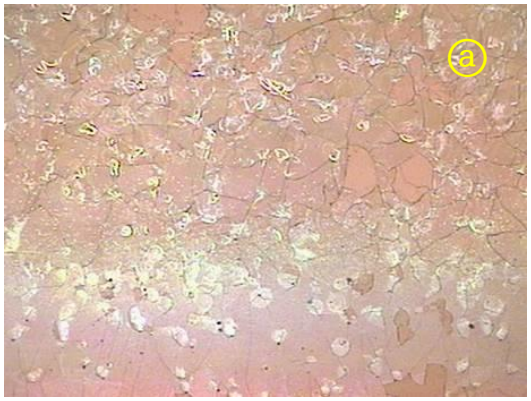




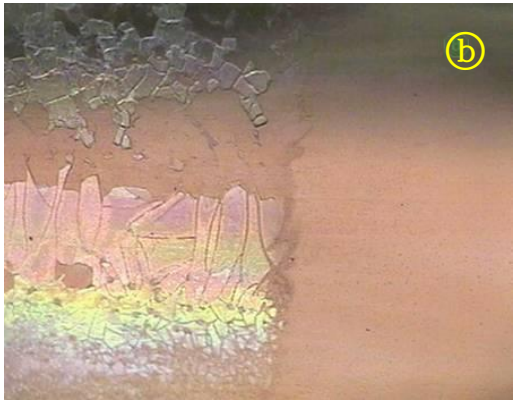


- Focus Ring (3) Cleaning

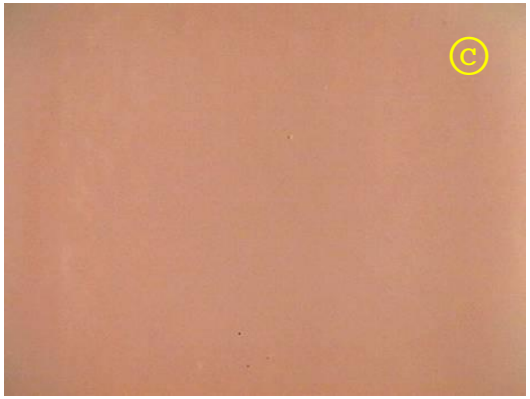




△ Deposition Layer



△ Chemical immersion interface

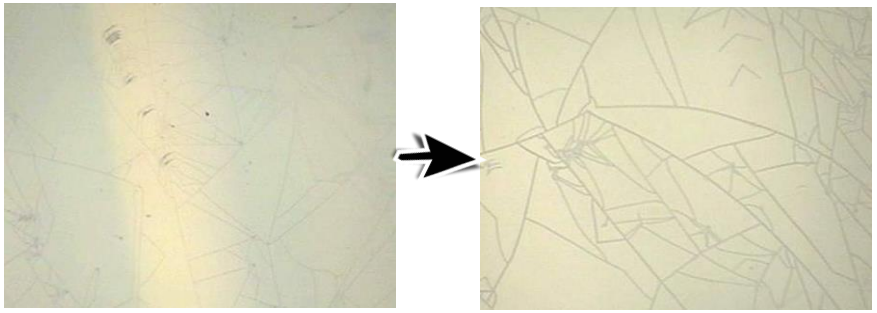


△ Damage free surface

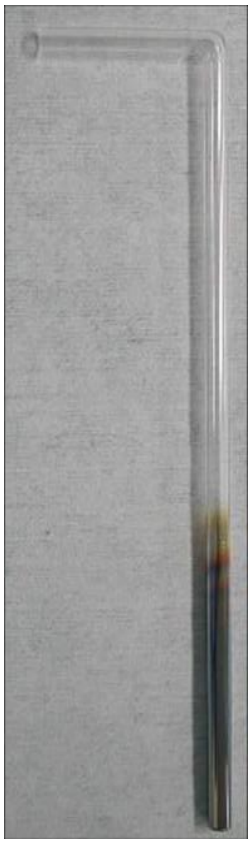
** Corrosive HF has an irregular surface damage due to the masking effect of deposition materials.

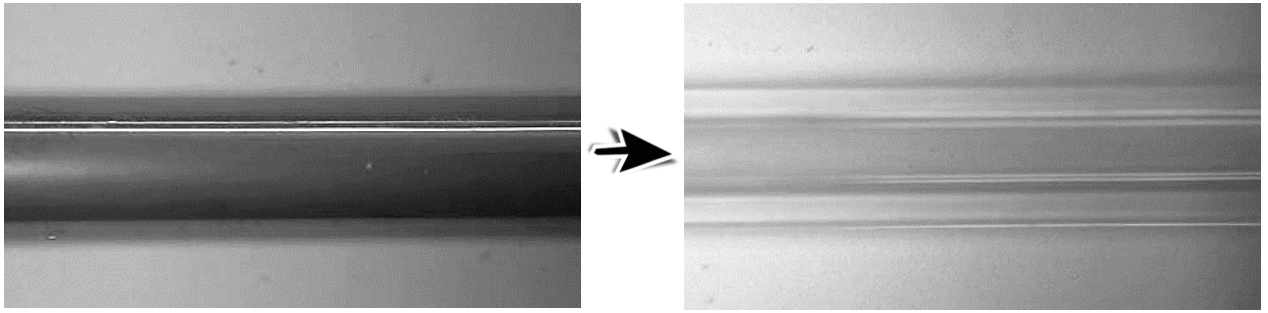
Quartz Parts Cleaning

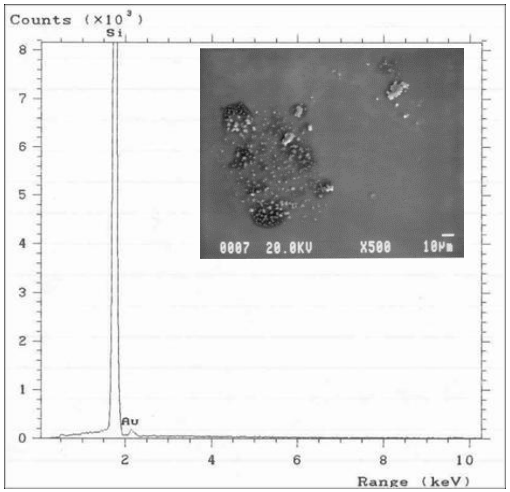
- LP Nozzle (SiN Depo') Cleaning



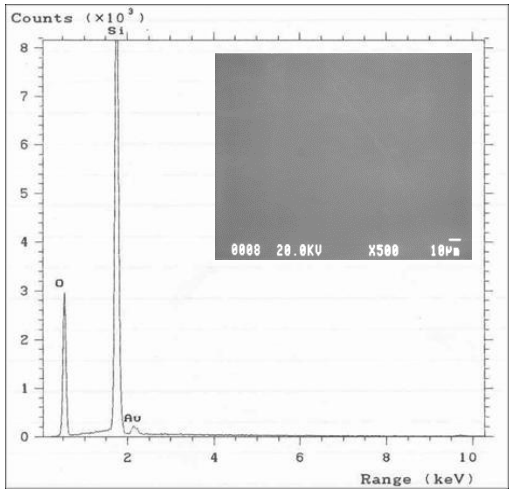
- LP Nozzle (Poly Si Depo') Cleaning Data







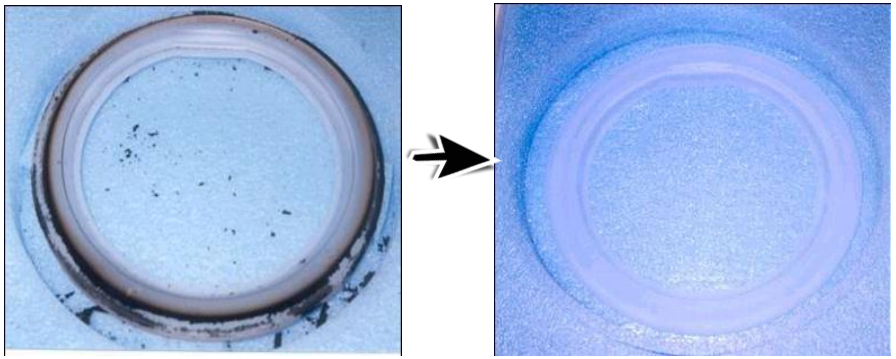
Depo' material : Poly Si

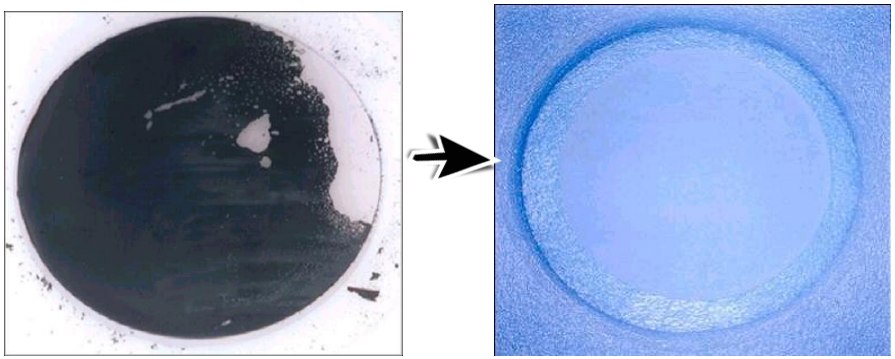


Cleaning out Depo' material
(New Chemical Only SiO2 peak)

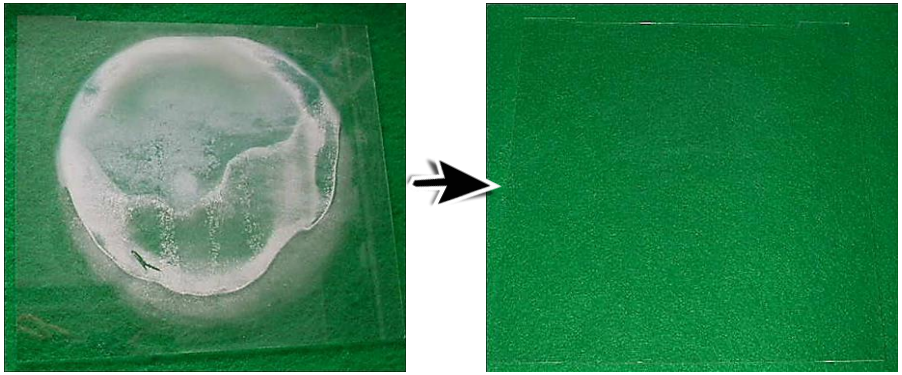
Quartz Parts Cleaning

- Guide Ring / GDP in Dry etcher Cleaning

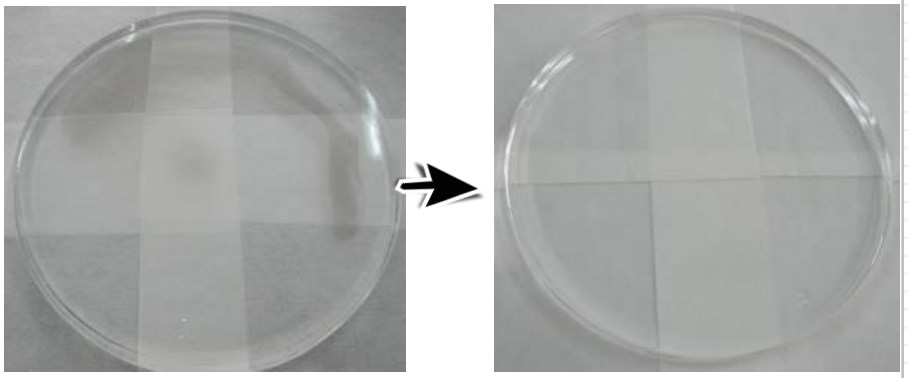


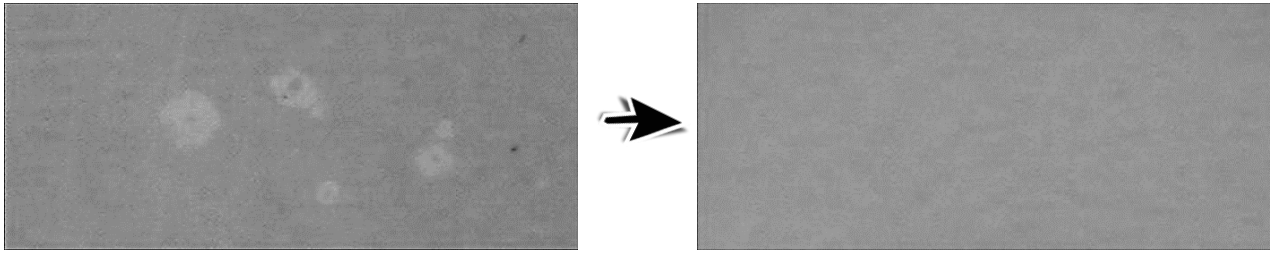


- Top Plat Liner Cleaning Data



- Quarts Window Cleaning Data

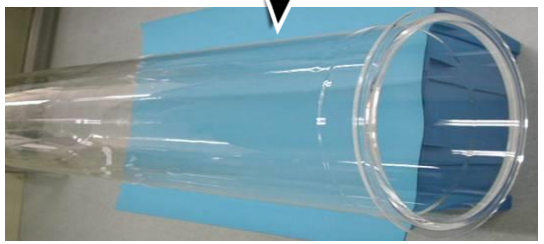


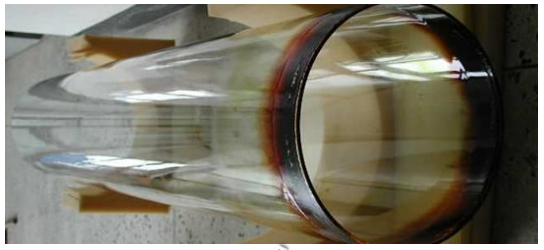


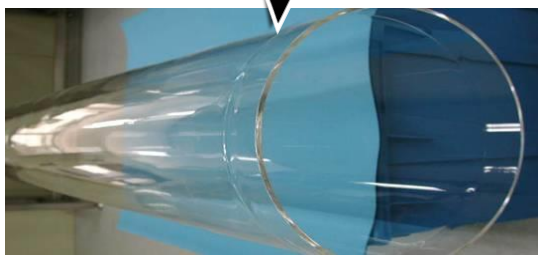
Quartz Parts Cleaning

- Outer tube (Si Depo') Cleaning

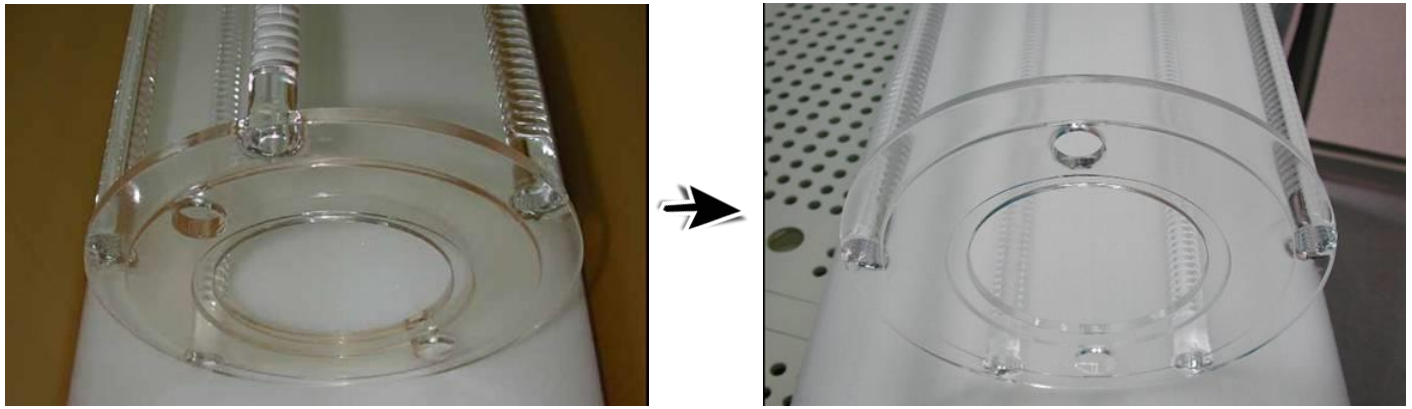
- Outer l Inner tube (resist Depo') Cleaning

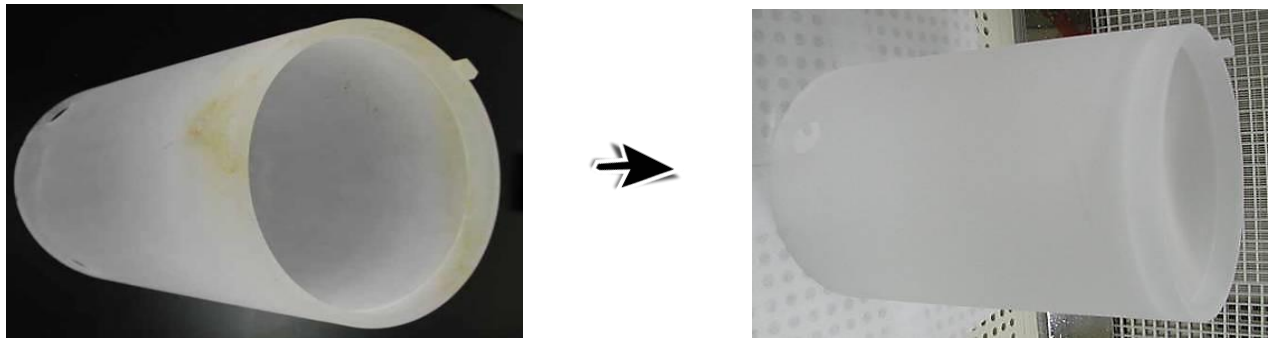


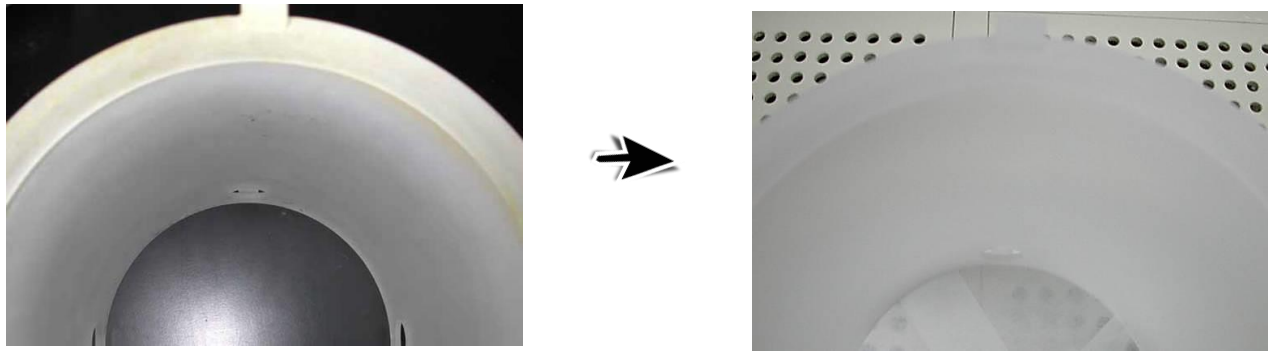




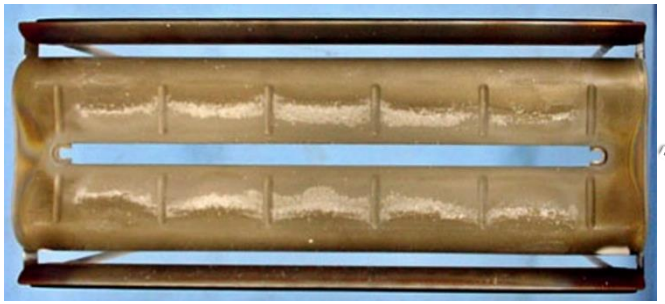
- Boat / Boat Stand Cleaning



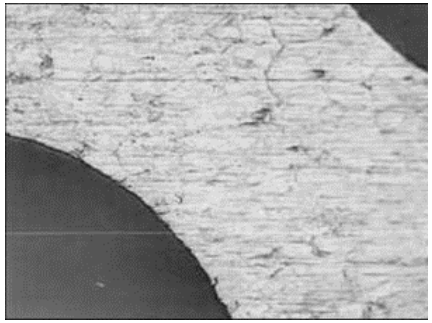




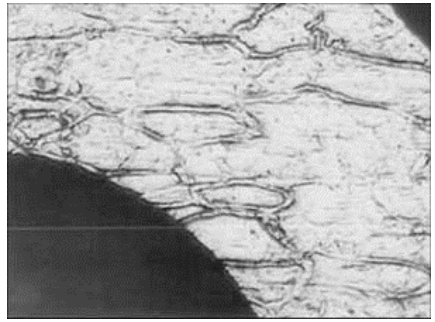
- N2 Shield Cleaning



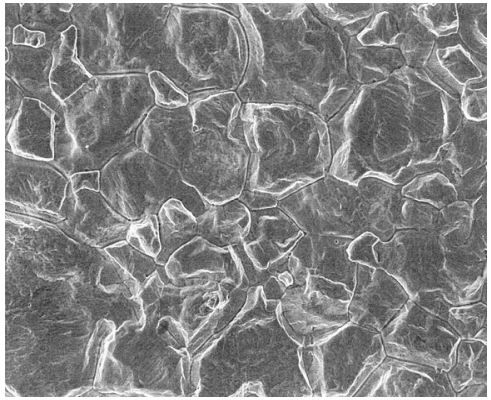
△ Original surface of around hole



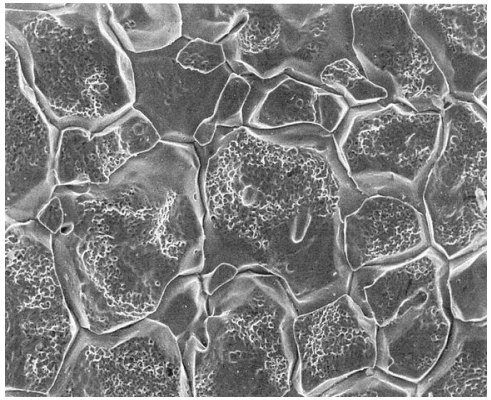
△ Damage free of New chemical



△ Surfaces damaged by HF



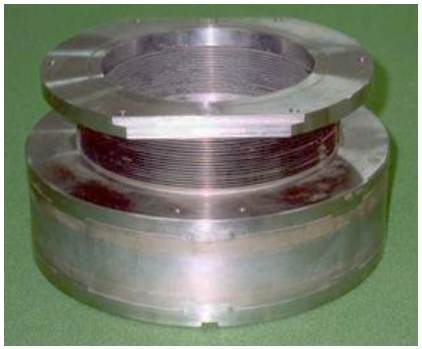
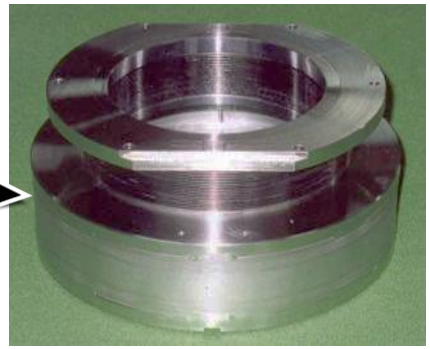
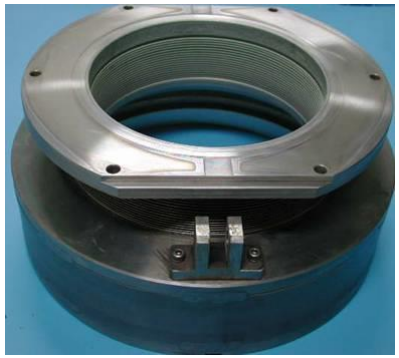
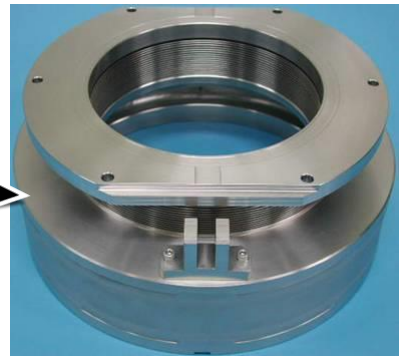
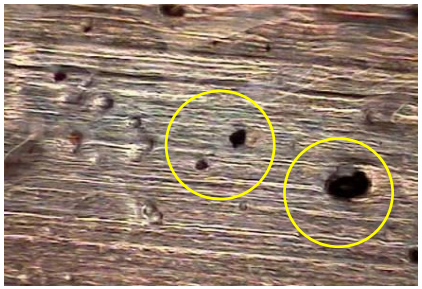
△ New chemical removes deposits without corrosion of metal.



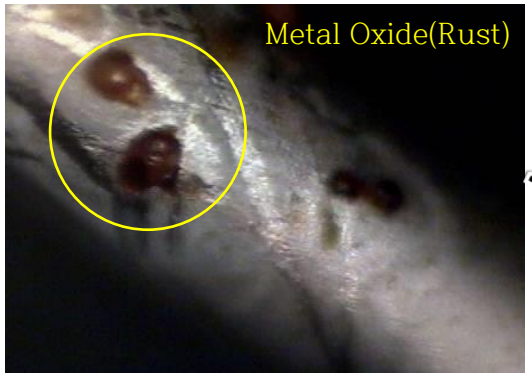
△ Grain boundaries are revealed by corrosion caused by mixed acid.

Stainless Steel Parts Cleaning

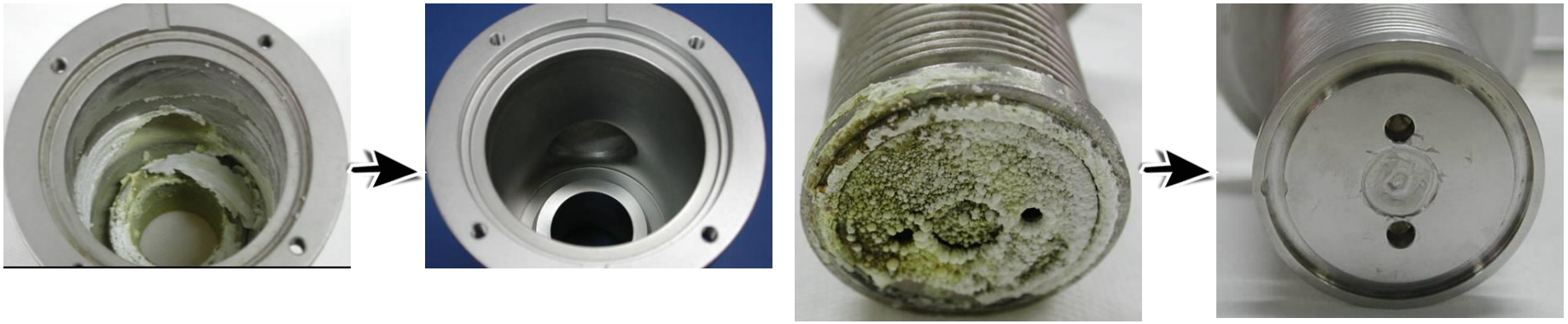
- Bellows Cleaning

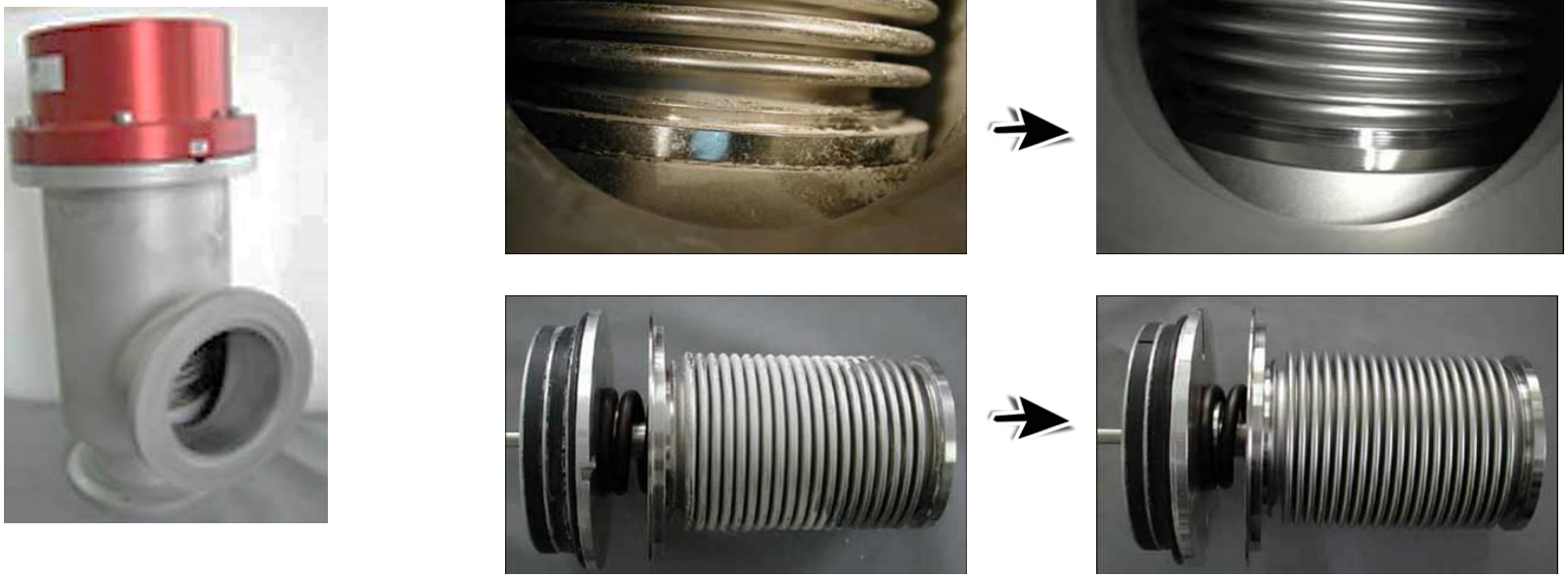




- Hot V/V O-ring Kit Cleaning

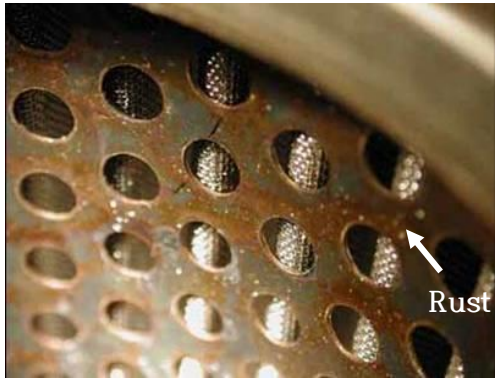


- MKS Main Valve Cleaning

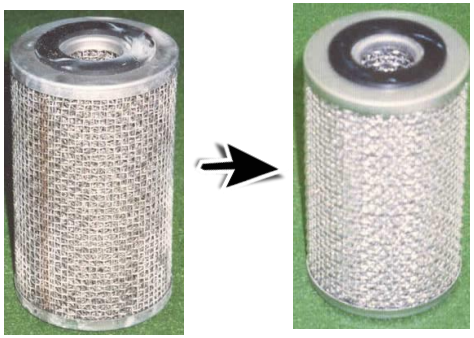


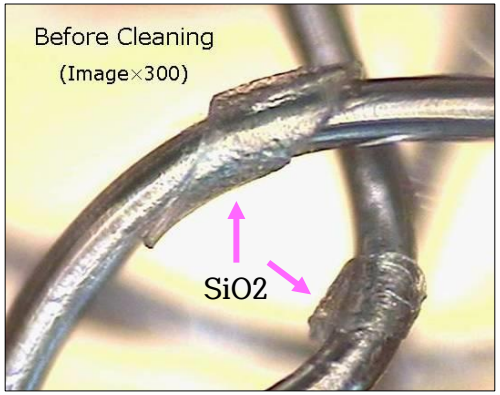
Stainless Steel Parts Cleaning

- Mono Trap Filter Cleaning

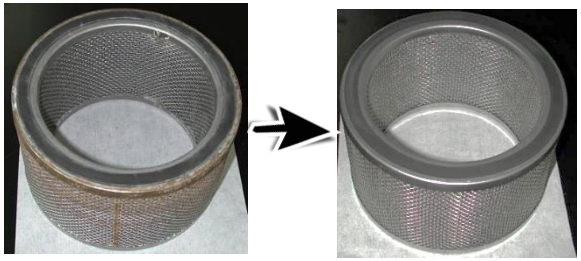


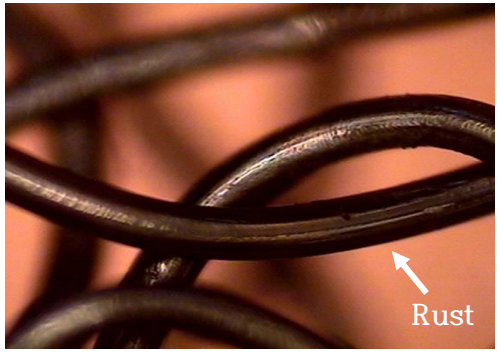
- Multi Trap Filter Cleaning

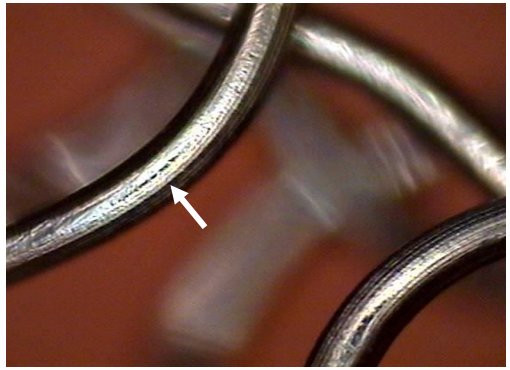




- MV Filter Cleaning Data

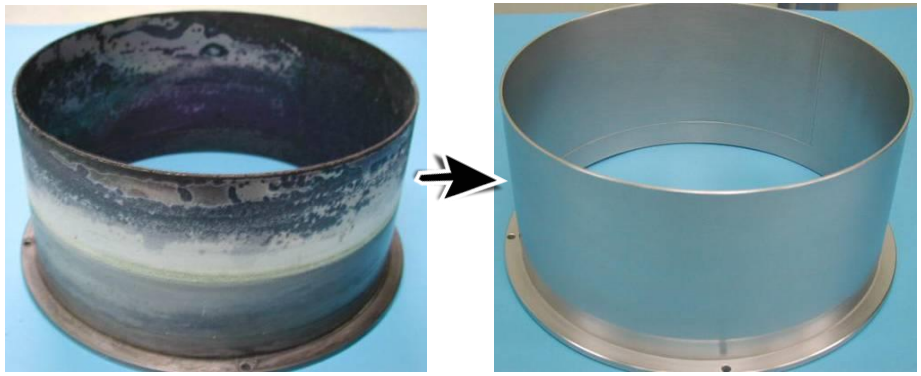




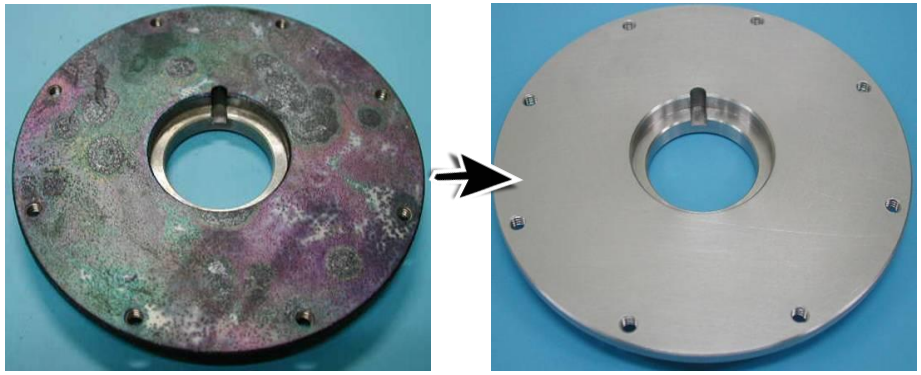


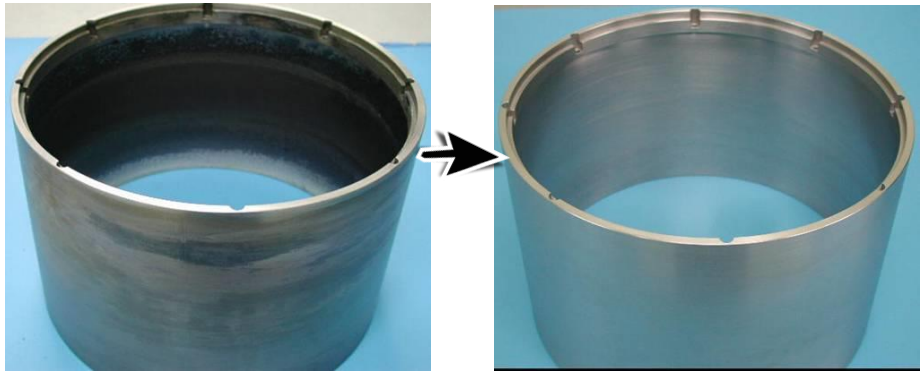
Stainless Steel Parts Cleaning

- ESC Side Cover Cleaning

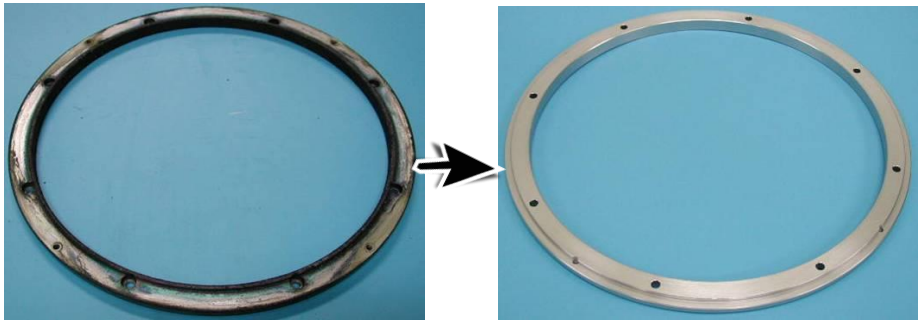


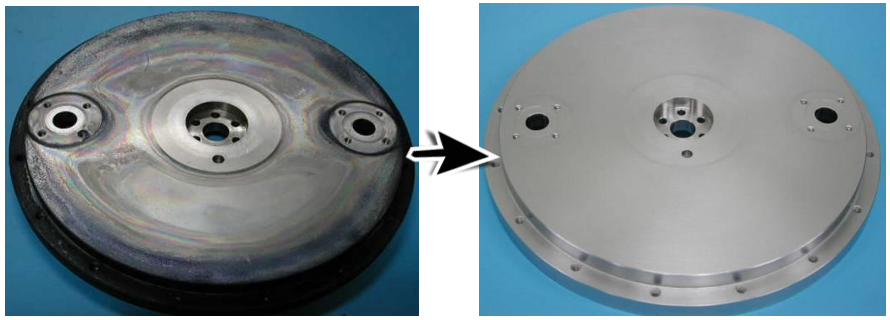
- ER Stage / ER Cylinder Flange Cleaning



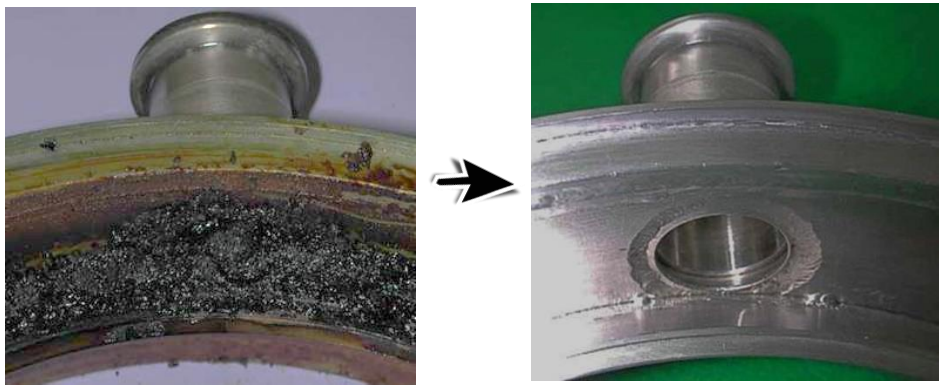


- ER Side Cover Flange / ESG Stage Cleaning

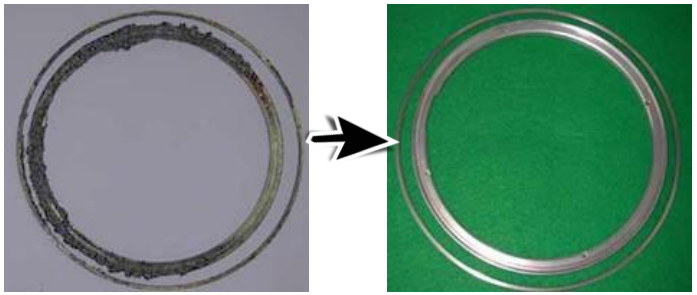


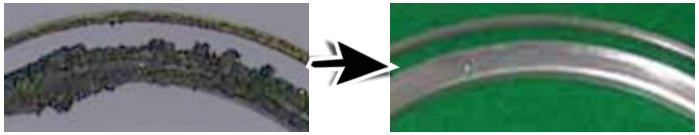


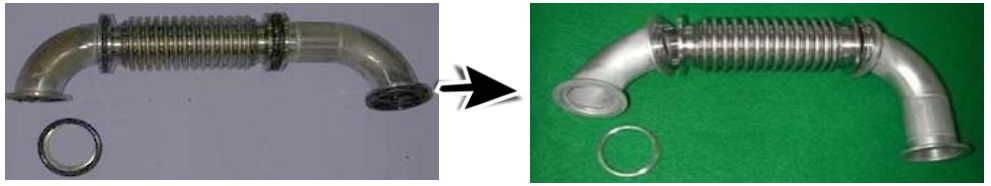
- Manifold Flange Cleaning

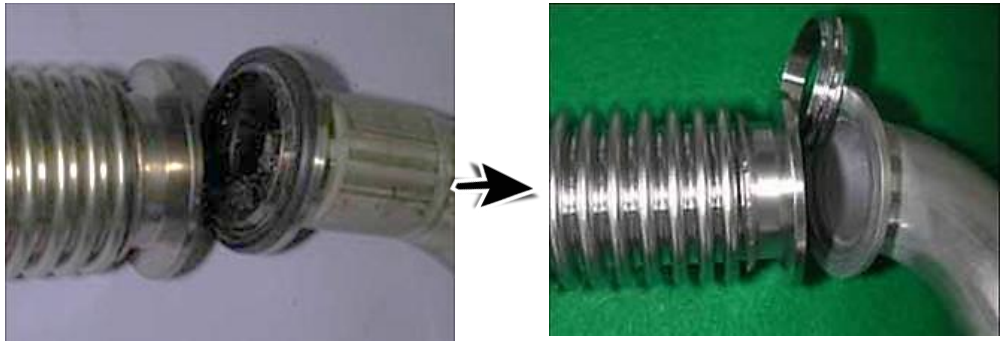


- Support Ring / Bellows / Elbow Cleaning









- Bellows / manifold / adaptor

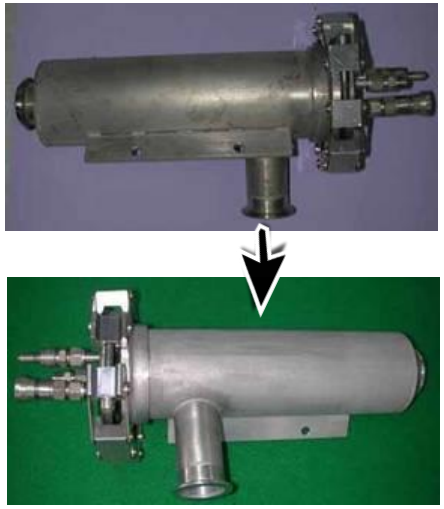


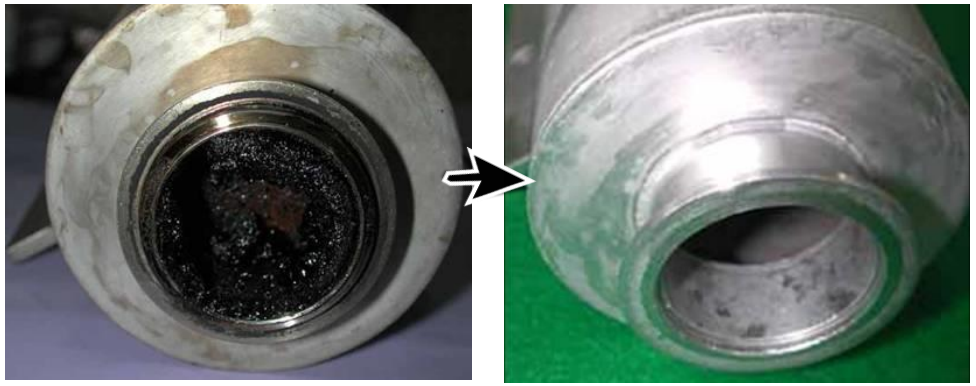


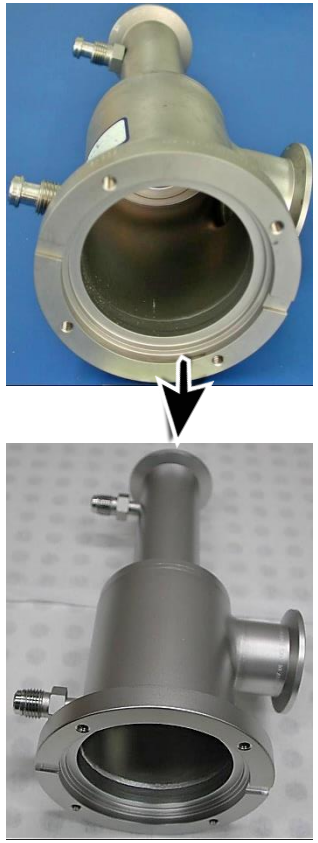


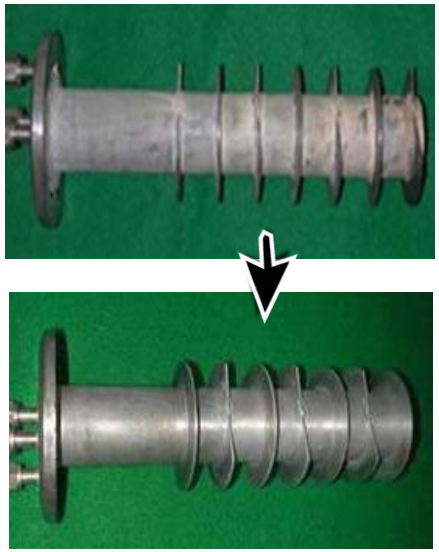



- Exhaust trap Cleaning









- Au Deposited SUS Shield Cleaning