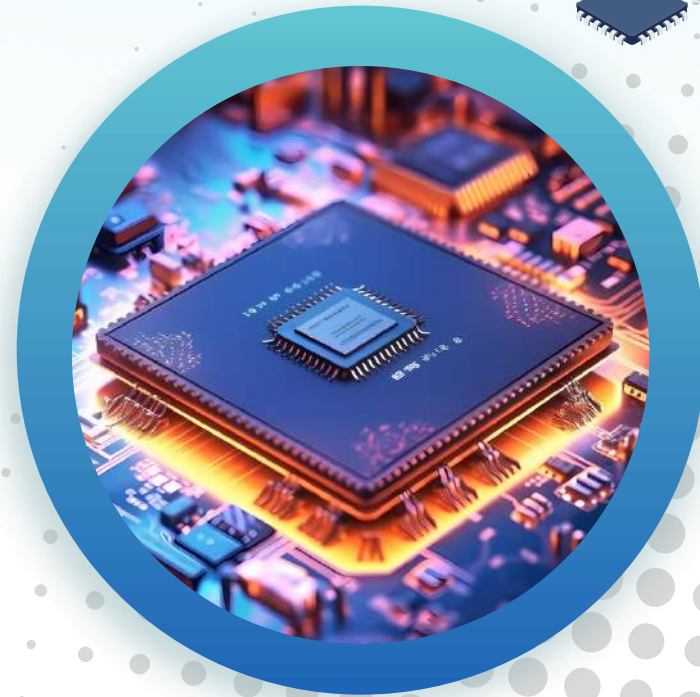
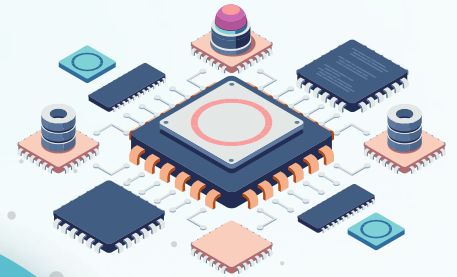




A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

Y_2O_3 & YF_3 Plasma Coating



Aldon Proprietary Information

Introduction - Plasma Spray

What is Plasma Spray Coating

Plasma Spray Coating – A process in which a heat source transforms metallic or non-metallic materials into a spray of molten or semi-molten particles that are deposited onto metal substrates.

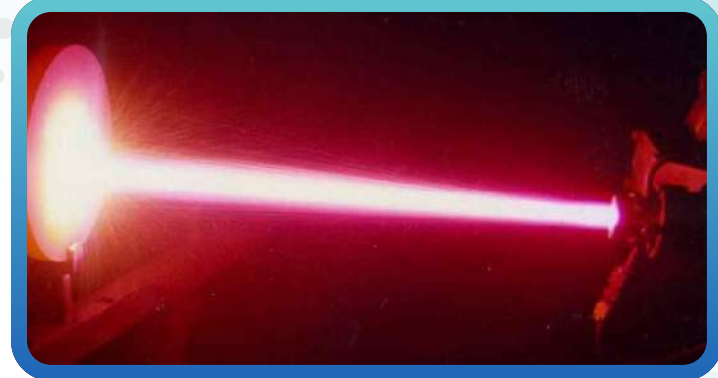
Plasma Spray System

- Advanced Plasma Chamber with Computerized-Control System and robot.
- Capable of spraying Aluminum, Tungsten Carbide, Al_2O_3 , Y_2O_3 , YF_3 etc coating material. Working dimensions 2.0m (L) x 1.5m (W) for automated process.
- Automated robotic arm spraying to ensure consistent and reliable process.

Automated Robotic Arm



Plasma Coating Spraying Illustration





A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

Plasma Spray Specification

- Specs ensures proper coverage of surface; too thick will result in easy peeling.
- Thickness requirement monitoring in-placed during coating and outgoing QA inspection.
- Customized Spray available according to Customer Requirements

Challenges / Limitations

- Manual spraying is adopted for hard-to-reach areas.
- As this is a line-of-sight process, there is limitation in coating deep and small diameter holes, parts with tight spaces.
- Parts must be handled with care to avoid coating chip off due to struck by hard objects.



A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

Advantages Of Plasma Spray

Advantages of Plasma Spray Coating in ATS

- Better particle control in etch chamber.
- Electrical insulation more superior than to just anodization.
- Higher deposition rate which results in lesser heat and stress applied to the metal parts which will not cause any damages to the parts.
- More superior hardness which improves MTBC and recycle time.
- Capable of spraying wide range of materials.
- Better bonding strength which will not result to crack, peeling and flaking problem.
- Cost savings. Recoat is cheaper than buying new parts.
- Localization of services will shorten the lead-time, our best support will be provided, and cost savings will be passed on to customers.
- Environmental friendly.



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

Y_2O_3 Plasma Coating

- Aldon is proud to offer advanced Y_2O_3 (yttrium oxide) plasma coating capabilities to support the demanding requirements of semiconductor wafer fabrication. Our commitment is to exceed customer expectations through consistent quality, reliable service, and the flexibility to adapt to diverse application needs.
- Our Y_2O_3 plasma coating service reflects our continuous effort to deliver value-added technologies and integrated solutions. By enhancing component durability and resistance to plasma-induced wear, our coating solutions help improve process reliability, increase equipment uptime, and support higher customer yield and throughput.



A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

Introduction - Y_2O_3 Plasma Coating



Yttrium Oxide (Y_2O_3)

- Below is additional information of Y_2O_3 material:
- Yttrium oxide, also known as yttria, is Y_2O_3 . It is an air-stable, white solid substance. Yttrium oxide, commonly used as starting material for both materials science as well as inorganic compounds.
- Purity : 99.9% - 99.9999%
- Molar mass: 225.81 g/mol
- Density: 5.01 g/cm³
- Melting point: 2,425 °C
- Boiling point: 4,300 °C

Aldon Proprietary Information



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

Advantages of Y_2O_3 Plasma Coating

- Higher grade and superior quality of material is used. Our coating EDX confirmed there are no contaminants within the powder material and coating processes.
- Good plasma resistance coating can improve the part lifetime. Some customers feedback that their part lifetime has been increased 2x.
- Higher bonding strength improve coating quality with less peeling problem.



A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

Introduction - YF_3 Plasma Coating

YF_3 Plasma Coating

- Aldon is proud to offer YF_3 (yttrium fluoride) plasma coating capabilities to support the demanding requirements of semiconductor wafer fabrication. Our commitment is to exceed customer expectations through consistent quality, reliable service, and the flexibility to adapt to diverse application needs.
- Our YF_3 plasma coating service reflects our continuous effort to deliver value-added technologies and integrated solutions. By enhancing component durability and resistance to fluoroine-induced wear, our coating solutions help improve process reliability, increase equipment uptime, and support higher customer yield and throughput.



A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

Introduction - YF_3 Plasma Coating



Yttrium Fluoride (YF_3)

- Below is additional information of YF_3 material:
- Yttrium oxide, also known as yttria, is Y_2O_3 . It is an air-stable, white solid substance. Yttrium oxide, commonly used as starting material for both material science as well as inorganic compounds.
- Purity : 99.9% - 99.999%
- Molar mass: 145.9 g/mol
- Density: 4.01 g/cm³
- Melting point: 1,387 °C
- Boiling point: 2,230 °C

Aldon Proprietary Information



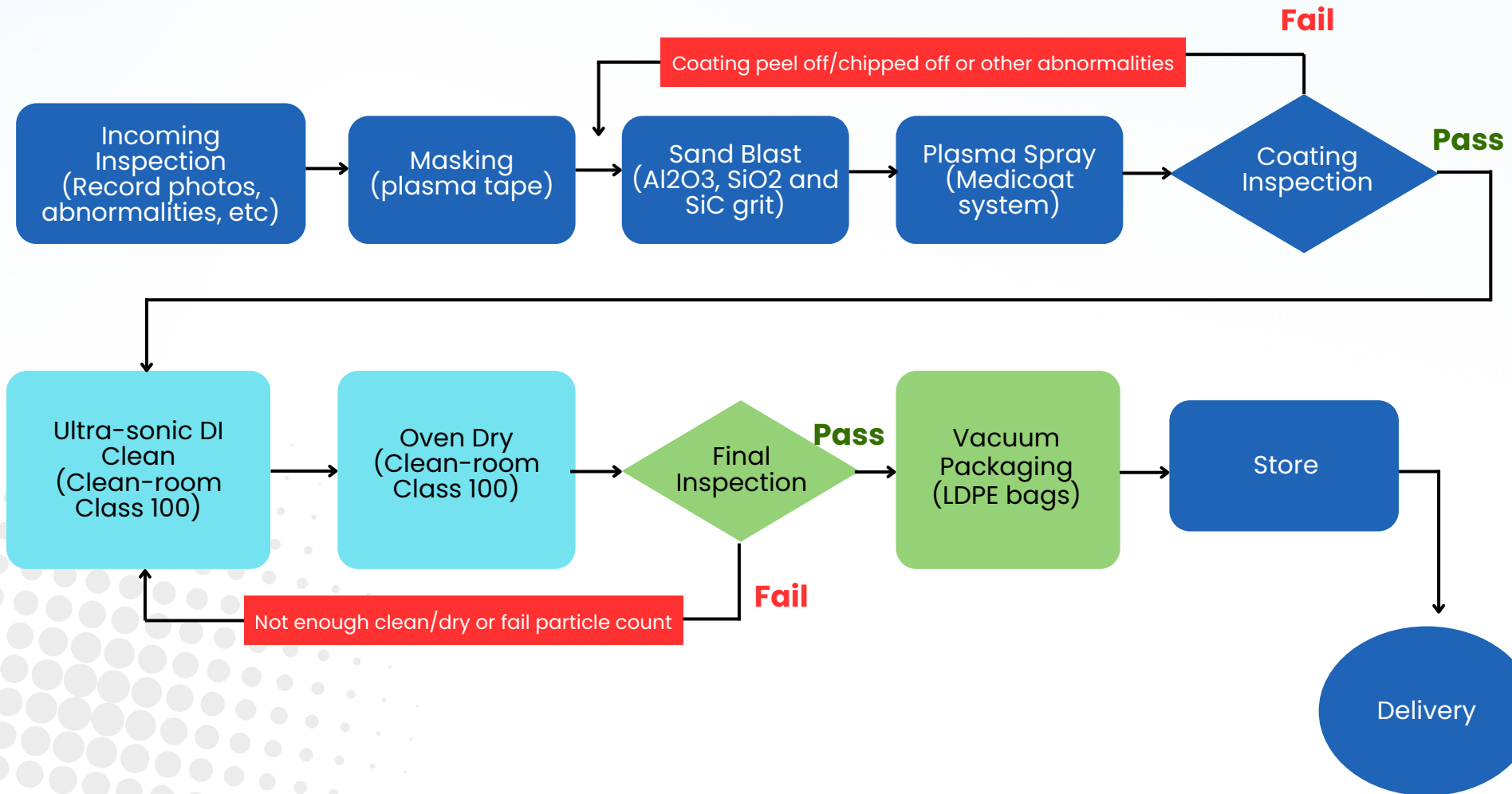
A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

Advantages of YF_3 Plasma Coating

- Can withstand aggressive chlorine and fluorine-based plasma environments.
- Excellent chemical stability in reducing plasma chemistries, which minimizes the chemical reaction.
- Higher dielectric strength compared to Y_2O_3
- Lower particle generation resulting in cleaner processes.

Plasma Spray Coating Process Flow





A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

Removal of Old Coating



After acceptance of Incoming inspection:

1. General Clean & drying
2. Masking for removal of Coating
3. Old coat is removed by blasting generally
4. Part is inspected for proper removal & masking is in placed
5. Touch up masking if needed
6. Place & secure part on Turntable in Plasma Chamber
7. Set robot program for each specific part
8. Plasma coating commence with set recipe (distance, pressure, angle and powder feed rate)
9. Inspection and Cleaning
10. Final Inspection & Delivery



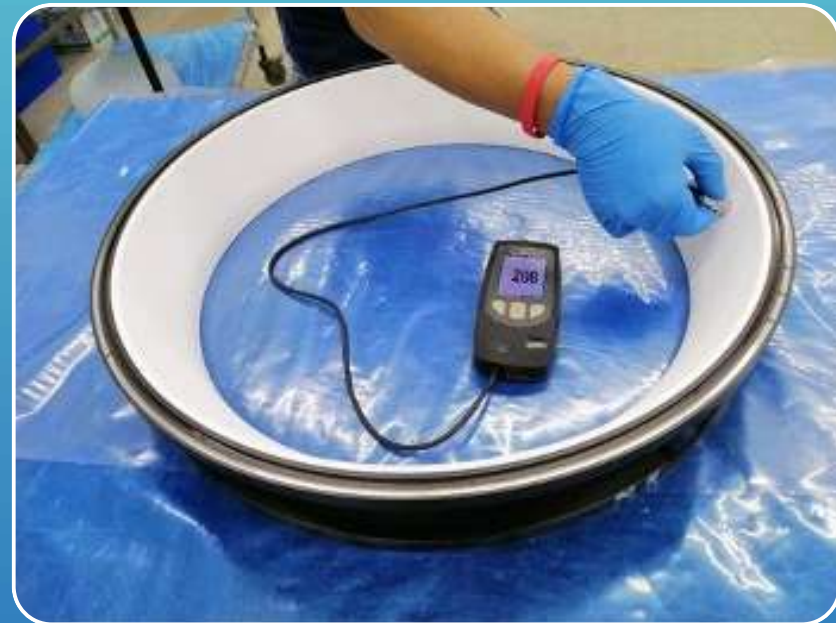
A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

QC Coating Inspection Illustration

QC Coating Roughness Measurement



QC Coating Thickness Measurement



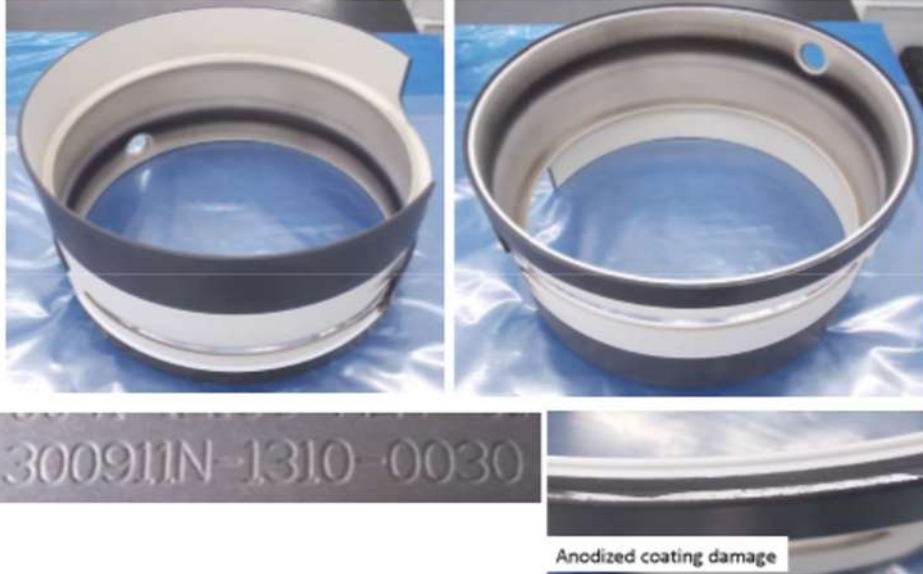
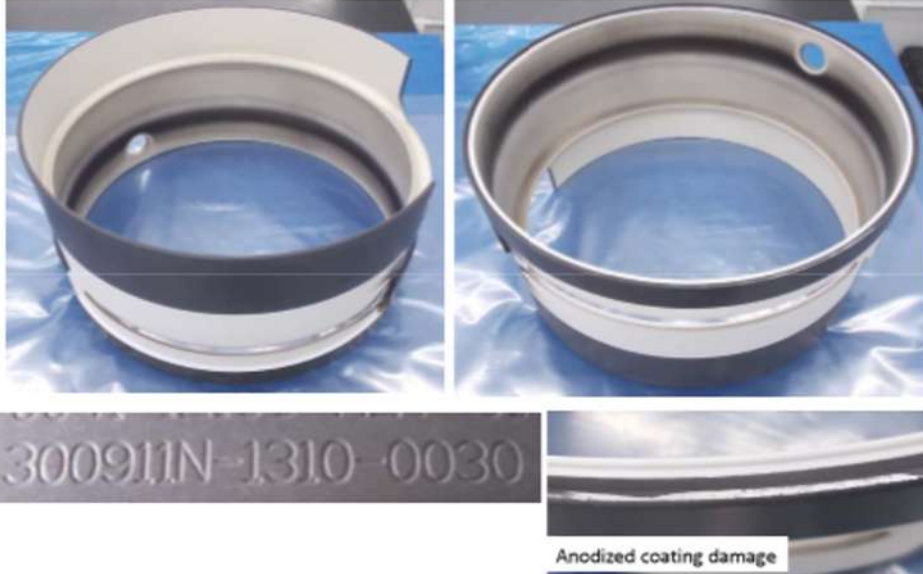
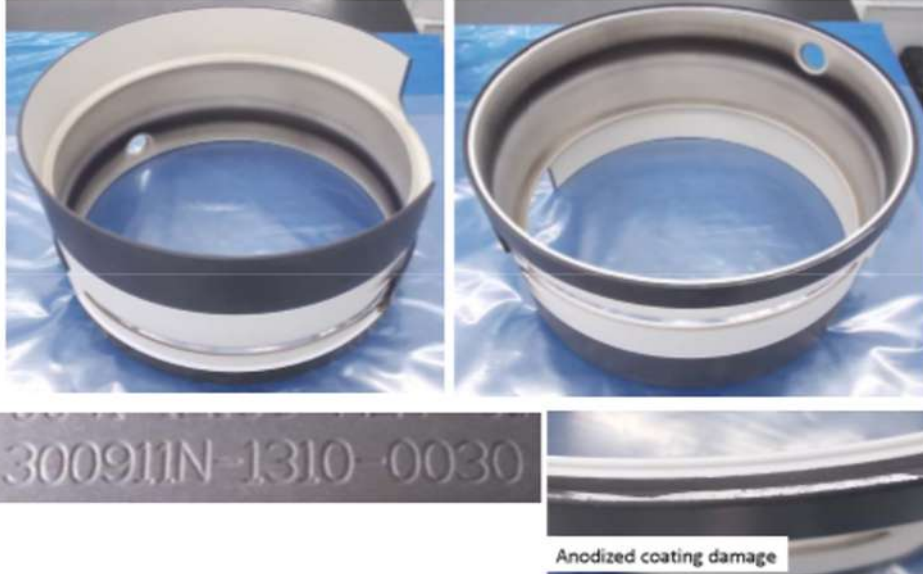
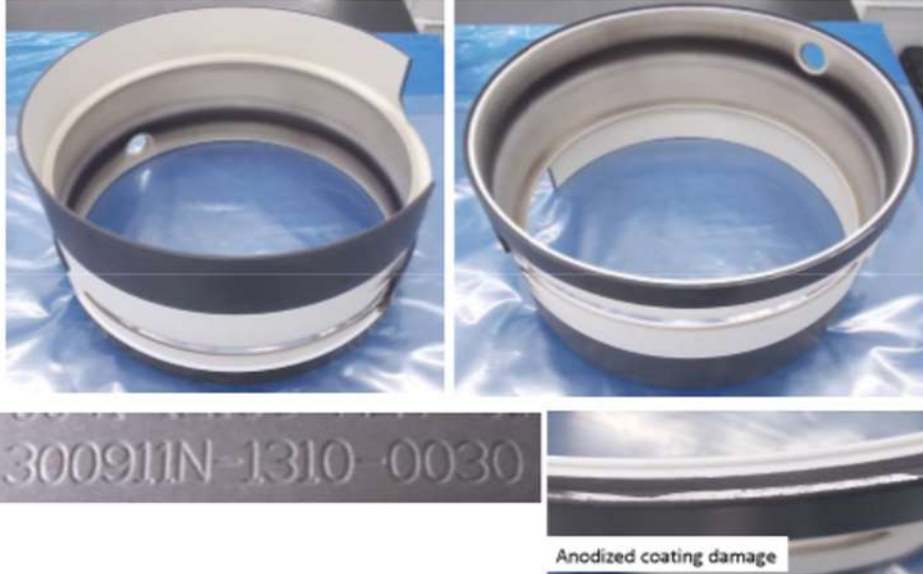
Aldon Proprietary Information



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

QC Inspection Reports

ATS A Company of Aldon Group			Incoming Inspection Report Y2O3 Coating			Ref No: JOA1802282-02A		
Part No.	0041-12166	Serial No.	300911N-1310-0030	Customer			Module	AMAT Parts
Name	Wall Liner		EGP No.	2018028278	Date In (yyyymmdd)	20181001	Date Out (yyyymmdd)	
Check Point	Anodizing Thk. (μm)	Y2O3 Thk (μm)	Pictures & illustrations:					
Spec	Ref only	Ref only						
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
Min.			Notes:					
Max.								
Avg.								
Insp. Result	ACCEPT							
Inspected by	Li Ting							
Reviewed by	ADAM							
								
Y0041-12166-s300911N-1310-0030-d20181001-JOA1802282-02A								

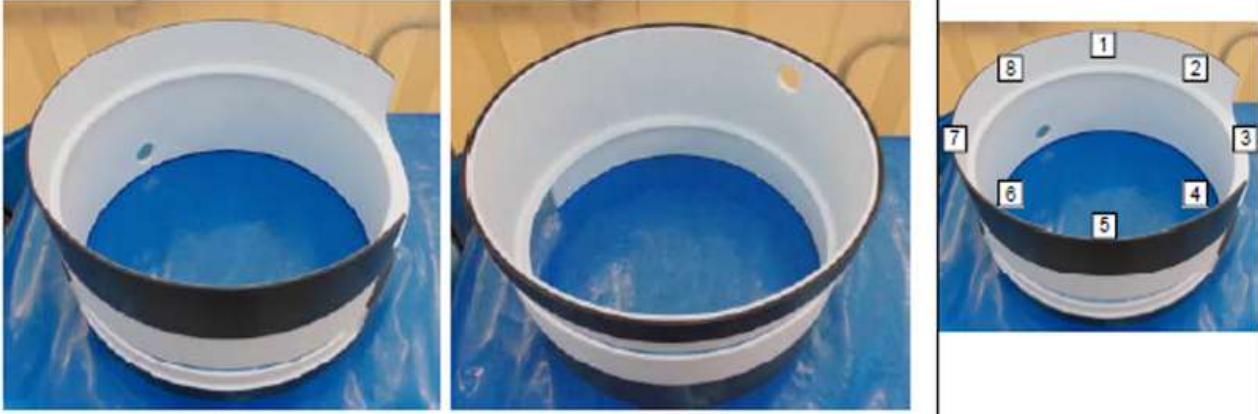
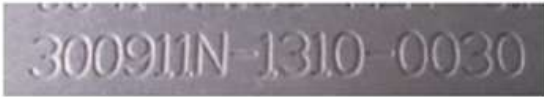
Visual Inspection	
	Scratches
	Dents
	Cracks
	Chips / Peel off
X	Stains
X	Anodized coating damage
	No Abnormalities Found



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

QC Inspection Reports

 A Company of Aldon Group		Final Inspection Report Anodize & Y2O3 Coating			Ref No: JOA1802282-02A	
Part No.	0041-12166	Serial No.	300911N-1310-0030	Customer		
Name	Wall Liner	EGP No.	2018028278	Date In (yyyymmdd)	20181001	Date Out (yyyymmdd)
					20181008	
Check Point	Anodizing Thk. (μm)	Y2O3 Thk (μm)	Pictures & illustrations:			
Spec	Ref only	200 / ±30				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
Min.						
Max.						
Avg.						
Surface Roughness (Ra 3.5 - 5.5 μm)			Notes:			
Surface Particle <5 cnt/cm² @ >0.3μm						
Insp. Result	ACCEPT					
Inspected by	Li Ting					
Reviewed by	ADAM					
						
Y0041-12166-s300911N-1310-0030-d20181001-JOA1802282-02A						

Visual Inspection	
	Scratches
	Dents
	Cracks
	Chips
	Stains
	Anodized coating damage
X	No Abnormalities Found

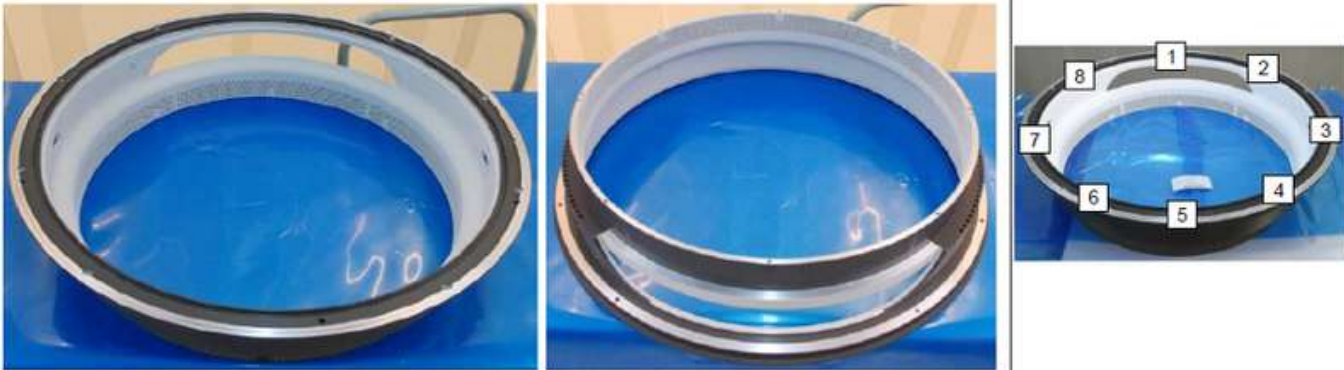
Aldon Proprietary Information



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

QC Inspection Reports

ATS A Company of Aldon Group			Final Inspection Report Re-Anodize & YF3 Coating			Ref No:	
Part No.	3D10-101195-11	Serial No.	15006KS-19511	Customer		Module	SCCM
Name	DEPO SHIELD	EGP No.		Date In (yyyymmdd)		Date Out (yyyymmdd)	
Check Point	Anodizing Thk. (μm)	Anodized and YF3 Thk (μm)	Pictures & illustrations:				
Spec							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
Min.							
Max.							
Avg.							
YF3 Roughness			Notes:		Visual Inspection		
Surface Particle <5 cnt/cm ² @>0.3 μm					Scratches		
					Dents		
					Cracks		
					Chips		
					Stains		
					Anodized coating damage		
					No Abnormalities Found		
Insp. Result	ACCEPT		Leak Test	Side Holes Water Check	Window Go Gauge Test		
Inspected by	Raja		Pass / Fail	Pass / Fail	OK / NG		
Reviewed by	Ming Chuan				Kit No	FJ30	X
							
Y3D10-101195-11-s15006KS-19511-d20160811-JOA1601494-03							

Aldon Proprietary Information



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

QC Inspection Reports

 A Company of Aldon Group		Final Inspection Report YF3 Coating			Ref No: 		
Part No.	3D10-202405-13	Serial No.	12018NC-54211	Customer		Module	TEL SCCM
Name	INSULATOR LOWER		EGP No.		Date In (yyyymmdd)	Date Out (yyyymmdd)	

Check Point	YF3 Thk (μm)	Pictures & illustrations:	
		Spec	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
Min.			
Max.			
Avg.			

YF3 Roughness		Notes:
Surface Particle <5 cnt/cm ² @>0.3 μm		
Insp. Result	ACCEPT	
Inspected by	Raja	
Reviewed by	Ming Chuan	

 Y3D10-202405-13-s12018NC-54211-d20160811-JOA1601494-01		Leak Test Pass /-Fail	Kit No FJ30
--	--	--------------------------	----------------

Visual Inspection	
	Scratches
	Dents
	Cracks
	Chips
	Stains
	Anodized coating damage
X	No Abnormalities Found

Plasma Spray Coating Quality Management

ST Kinetics
Singapore Test Services
A member of ST Engineering

Singapore Test Services Pte Ltd
Main Office:
140 Jooat Street, Singapore 11621
Tel: (65) 6355 1211 / (65) 6355 1222
Fax: (65) 6351 2017
Website: www.sts.com.sg
E-mail: sts@sts.com.sg
(Page No. 150001152)

Branch Office:
2001 470 Ang Mo Kio Avenue 10
#01-01/02, SINGAPORE 569632
Tel: (65) 6344 2887 Fax: (65) 6344 2888

Report No: 03019-0318-00921-MEEM
Date of Report: 15 March 2018
Page 1 of 1

Client's Reference: POF180107
Report Title: Bond Strength Testing
Client Details: Aldon Technologies Services Pte Ltd
20 Loyang Lane
Singapore 508919
Attn: Mr Chai Yim
Sample Description: Three (3) pairs of ERP: SV-TT Specimen for Bond Strength Test
(1 Coated with Y283 Coating & 2 uncoated bond spec) labelled as in table 1.
Test Standard: ASTM C631-13 "Standard Test Method for Adhesion or Cohesion Strength of Thermal Spray Coatings"
Test Equipment: Universal Testing Machine, MTS / SDVTECH 45G
Speed Rate: 1mm per minute
Date of Receipt: 13 March 2018
Date of Test: 14 March 2018
Location of Test: 240 Jalan Besar, Singapore 210223
Results of Testing: Table 1: Bond Strength Test Results

Sample Reference	Coated with Y283 Coating		
	Sample 1	Sample 2	Sample 3
Bonded Area in^2	0.764	0.767	0.764
Maximum Load N	4329	5186	4905
Bond Strength psi	8284	7622	6627
Bond Strength MPa	57.14	48.43	41.37
Failure Mode	Failure at Coating & Glass/Coating Interface		

Results Reported By: Tan Soon Long
Reporting Officer

Report Approved By: Tan Chai Kheng
Supervisor
Materials Engineering Division

This report is issued in accordance with STS Terms and Conditions, which are available here. A copy of what is usually available at www.sts.com.sg.
The report shall not be reproduced except in full, unless written approval is sought from the issuing laboratory.

Coating Quality Acceptance Criteria

Tensile Bond Strength Analysis



Highlights of analysis:

- Average tensile bond strength of 49.04 MPa was achieved. This is higher than the 10.5 MPa achieved by Standard Part.



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

Plasma Spray Coating Quality Management

EDX

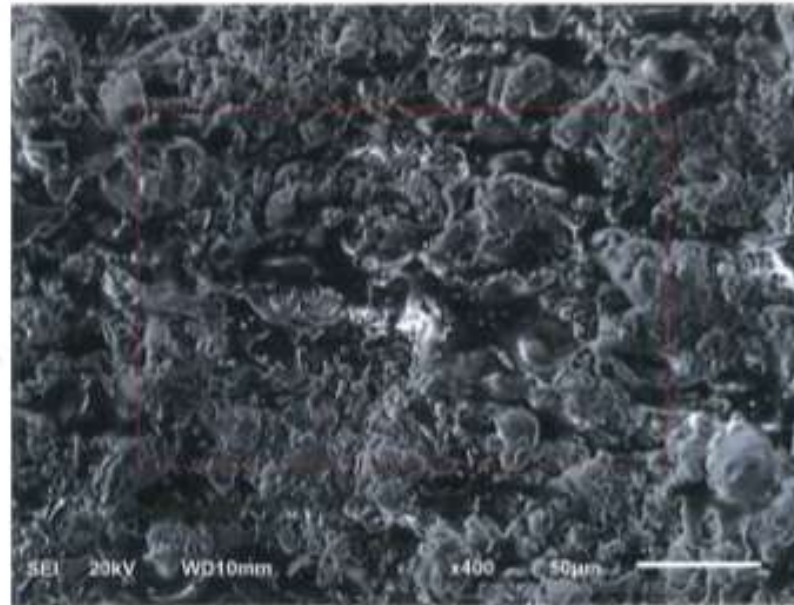


Figure 2a: Typical SEM image of test coupon '5', 400X

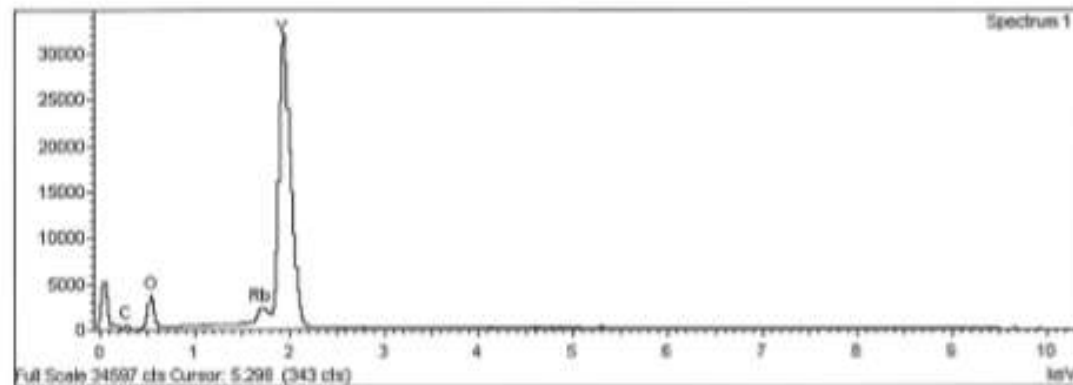


Figure 2b: Typical EDX spectrum of test coupon '5'

Table 2: Elements percentage breakdown for test coupon '5'

Element	Y	O [*]	Rb
Wt %	72.6	25.8	1.6

* Semi-quantitative result for Oxygen was included as per client's request.

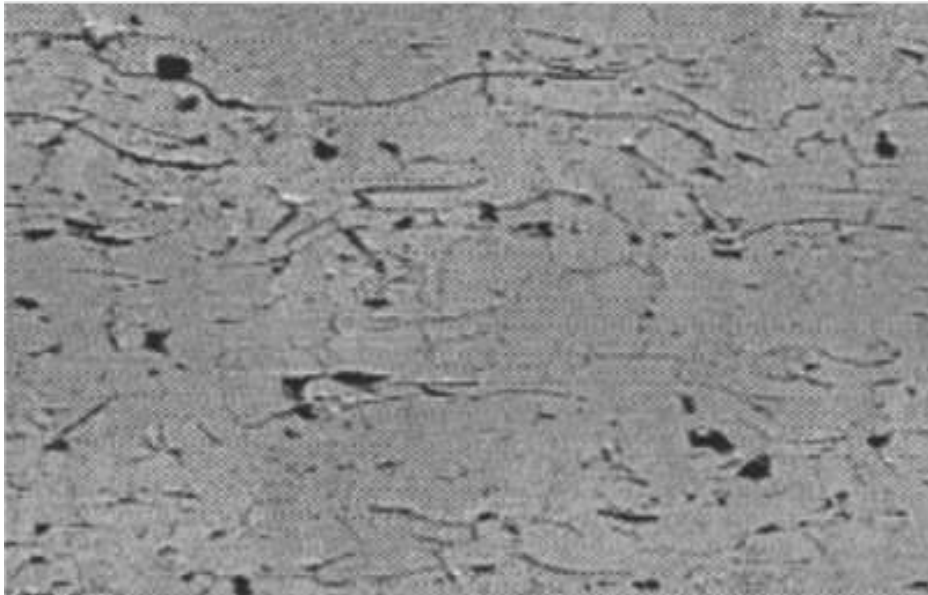


A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

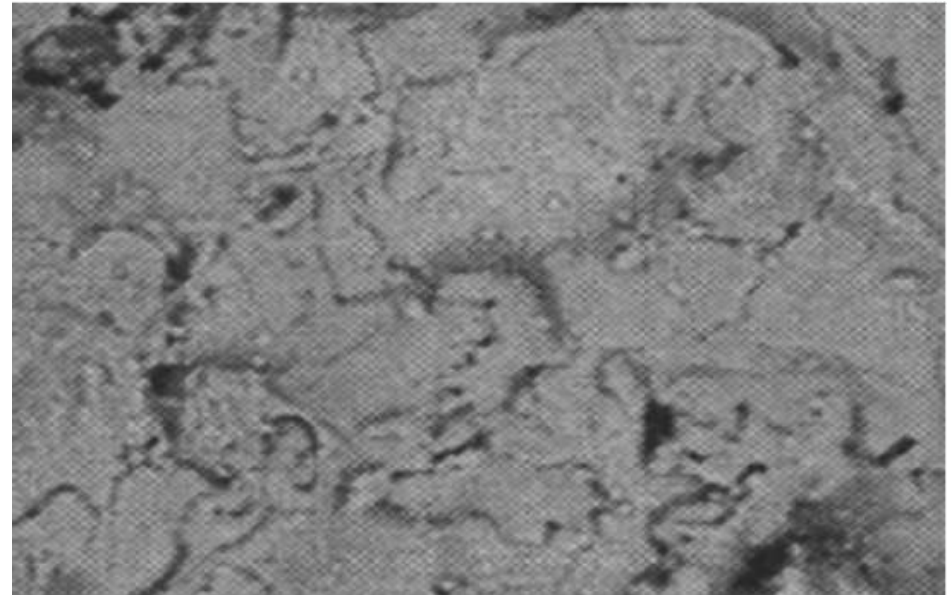
Plasma Spray Coating Quality Management

Porosity



Porosity good = with small gaps

Surface melt



Surface melt good = even surface melts

Plasma Spray Coating Quality Management

EDX

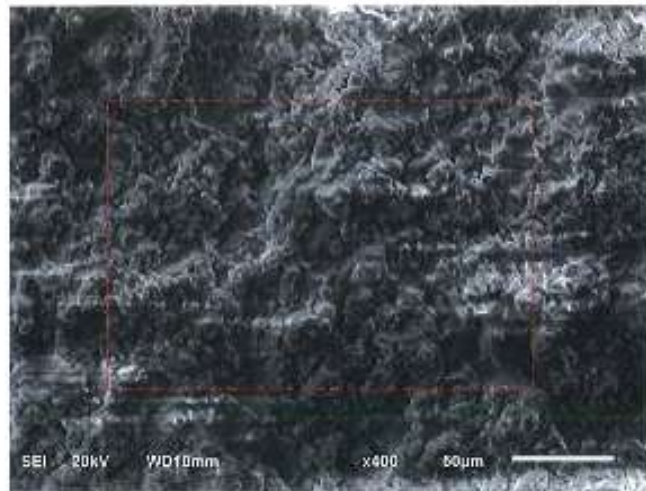


Figure 4a: Typical SEM image of test coupon '12', 400X

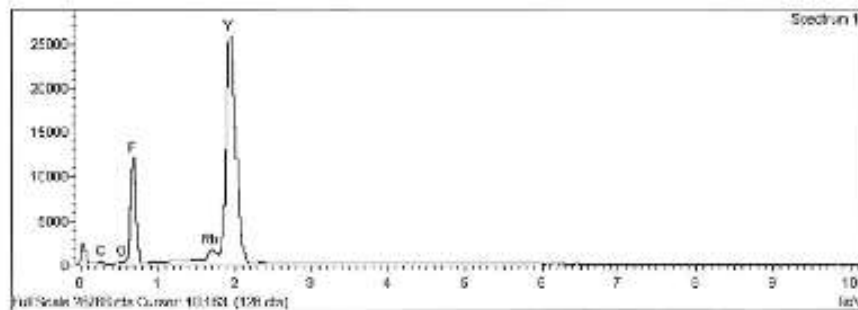


Figure 4b: Typical EDX spectrum of test coupon '12'

Table 4: Elements percentage breakdown for test coupon '12'

Element	Y	F	Re
Wt %	53.2	45.8	0.9

Porosity



Figure 3: Typical cross-sectional view of the coating for test coupon 'PCR', as-polished, 200X

Bond Strength

- Average tensile bond strength of 30 MPa



A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

ATS Quality Management

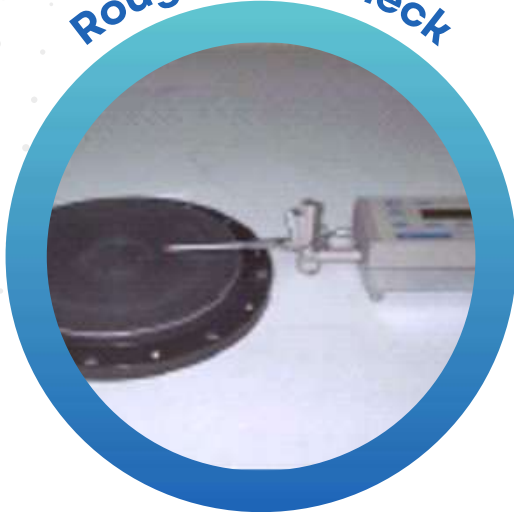
Coating Thickness Meter



Breakdown Voltage



Roughness Check



Clean-room Assembly



Vacuum Packing



Aldon Proprietary Information



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

LAM KIYO

S/N	OEM Part#	Description	Material	Photo
1	715-027638-814/824	Top Chamber (Kiyo 45)	Al Partially Coated Y_2O_3	
2	715-042721-810	Hi Flow Liner (Kiyo 45)	Al Partially Coated Y_2O_3	
3	714-045743-809	Outer Liner (Kiyo 45)	Al Partially Coated Y_2O_3	
4	715-045710-807	Liner Door (Kiyo 45)	Al Partially Coated Y_2O_3	
5	715-801021-838	Upper Chamber	Al Partially Coated Y_2O_3	
6	715-801916-808	GDP	Al Partially Coated Y_2O_3	



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

LAM CX

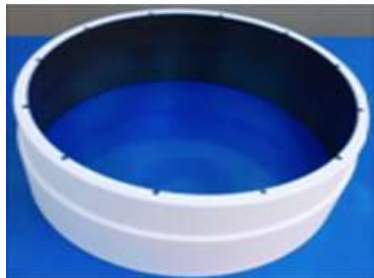
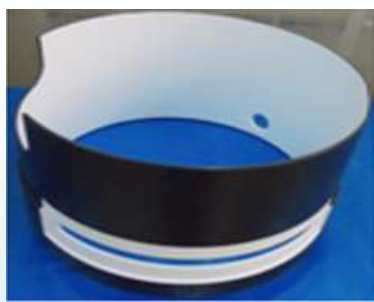
S/N	OEM Part#	Description	Material	Photo
1	715-027638-822	CX Top Chamber	Al Partially Coated Y ₂ O ₃	
2	715-042721-866	CX Hi Flow Liner	Al Partially Coated Y ₂ O ₃	
3	714-045743-809	CX Outer Liner	Al Partially Coated Y ₂ O ₃	
4	715-045710-807	CX Liner Door	Al Partially Coated Y ₂ O ₃	



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

AMAT Producer

S/N	OEM Part#	Description	Material	Photo
1	0021-27883	Slit Door	Al Partially Coated Y_2O_3	
2	0021-34196	Cathode Liner	Al Partially Coated Y_2O_3	
3	0040-99548	Chamber Liner Left	Al Partially Coated Y_2O_3	
4	0040-99549	Chamber Liner Right	Al Partially Coated Y_2O_3	



A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

TEL DRM

Item	OEM Part#	Description	Material	Photo
1	1D10-315183-15	Shield Depo 85-M4 (Y2-Y) (DRM2)	Al Inner Coated Y203	
2	1D10-315182-12	Depo Shield Window(YC-2) (DRM2)	Al Partial Coated Y203	
3	1D10-102848-13	Plate Baffle M-9 (Y2-Y) (DRM2)	Al Partial Coated Y203	
4	1D10-204418-12	Bellows Cover A-2 (Y2-Y) (DRM2)	Al Partial Coated Y203	
5	1D10-204338-13	Upper Electrode P-V2 (DRM2)	Al Partial Coated Y203	



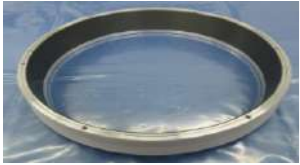
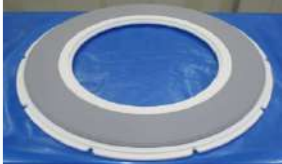
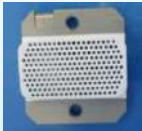
A Company of Japan Material Group

ALDON TECHNOLOGIES SERVICES PTE LTD

TEL SCCM

S/N	OEM Part#	Description	Material	Photo
1	3D10-302734-12	Window, Depo Y-AL, SE	Al Partially Coated Y_2O_3	
2	3D10-101152-13	Shutter BTM Type Y-AL SE	Al Partially Coated Y_2O_3	
3	3D10-100844-11	RING BTM Shield Y-AL SE	Al Partially Coated Y_2O_3	
4	3D10-201706-21	Spacer Gap50 Y-AL SE	Al Partially Coated Y_2O_3	
5	3D10-100845-11	Exhaust Plate Y-AL, SE	Al Partially Coated Y_2O_3	
6	3D10-101195-11	Depo Shield D3.0P0.8 P35, 6Y-A	Al Partially Coated Y_2O_3	
7	3D10-202405-13	Insulator Lower T32-R6-BL-NC	Ceramic Partially Coated Y_2O_3	

Parts List - TEL TACTRAS

S/N	OEM Part #	Description	Photo
1	3D10-150836-11	TEL TACTRAS Plate Exhaust	
2	3D10-150837-11	TEL TACTRAS Shutter	
3	3D10-150835-11	TEL TACTRAS Shield Depo	
4	3D10-251434-11	TEL TACTRAS Ring BTM Shield	
5	3D10-251356-12	TEL TACTRAS Insulator Lower	
6	3D10-350344-12	TEL TACTRAS Window Depo CLP	



A Company of Japan Material Group
ALDON TECHNOLOGIES SERVICES PTE LTD

Typical Parts Lists (Brand New or Refurbishment)

**TEL Tools
Chamber Parts**

**LAM Tools
Chamber Parts**

**AMAT Tools
Chamber Parts**

**AMEC Tools
Chamber Parts**

**LCD TEL Etcher
Chamber Wall
Parts**

**Ability to tailor
made and Y_2O_3
plasma coated
according to
customer's
requirements**