Water Erosion Resistant Surface Treatments
Nitriding of Ti6Al4V
TiAl coating

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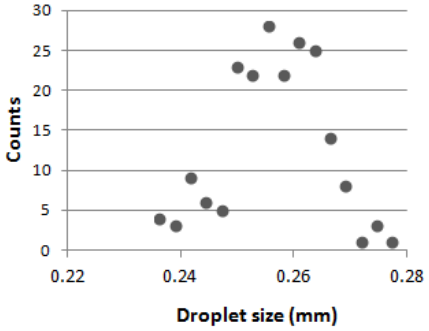
Outline

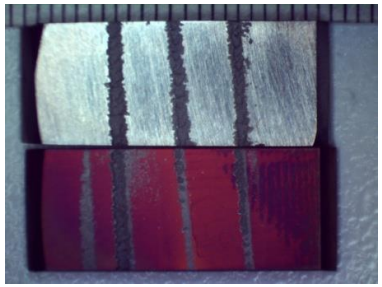
- Gas nitrided
- Lasr nitrieded
- TiAl cold sprayed coating

Previous meeting

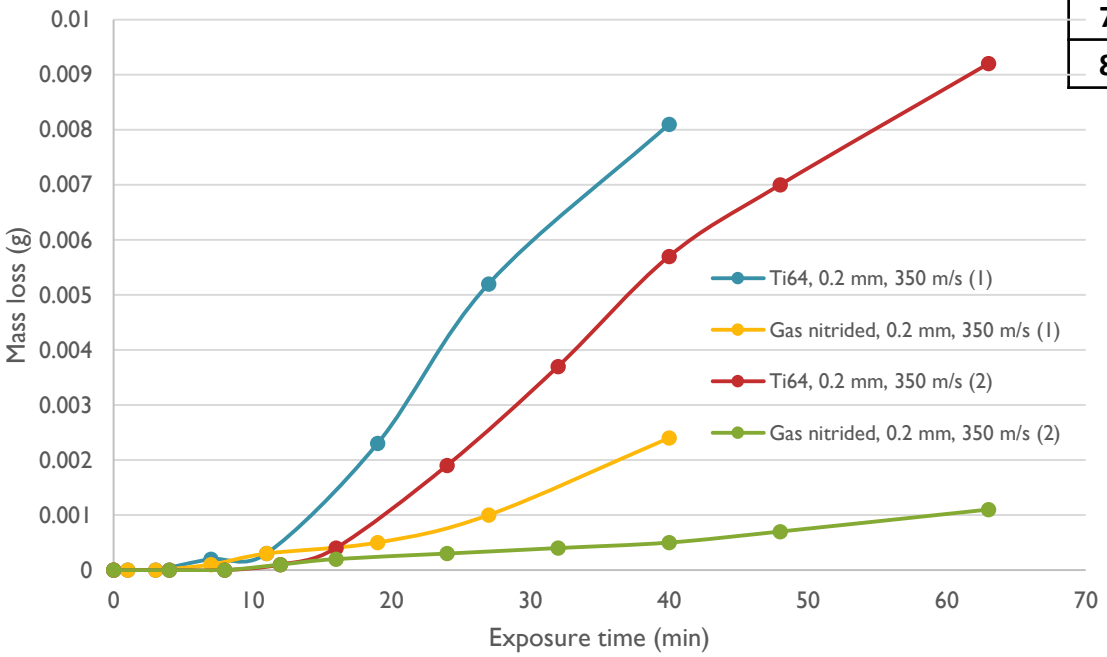
Erosion result of gas and laser nitrided Ti64

WDE of gas nitriding of Ti6Al4V





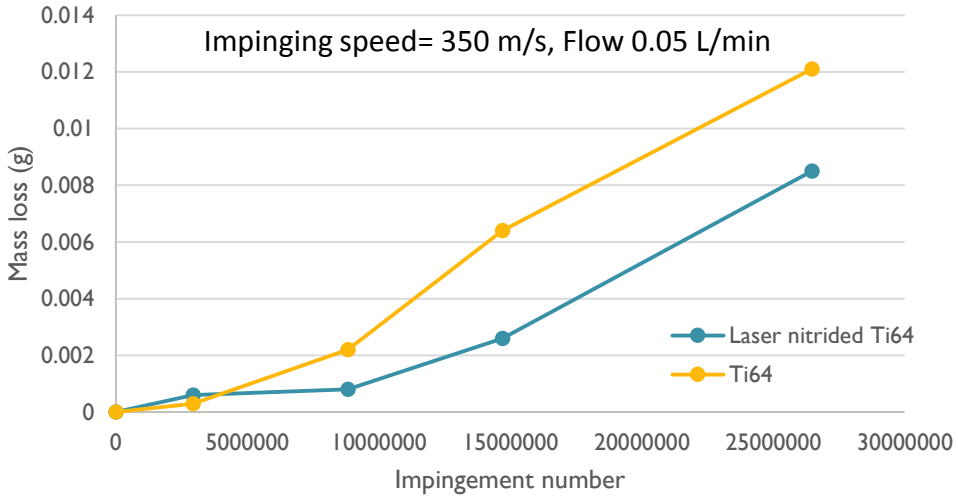
	Temperature (°C)	Time (h)	N_2 flow (SCCM)
1	1050	10	25 ✗
2	1050	2	100
3	900	2	25 ✗
4	1050	10	100
5	900	10	25 ✗
6	1050	2	25 ✗
7	900	10	100
8	900	2	100



First try
Water flow: 0.04 L/min

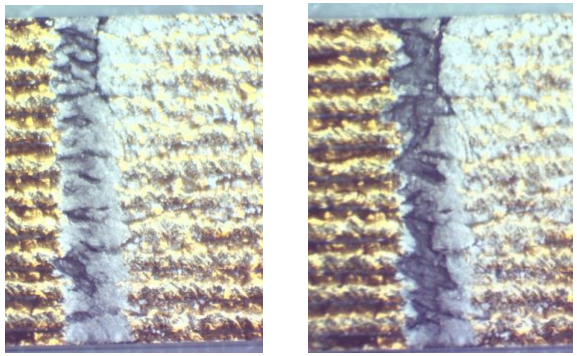
Second try
Water flow: 0.025 L/min

WDE of laser nitrided Ti6Al4V Coupons



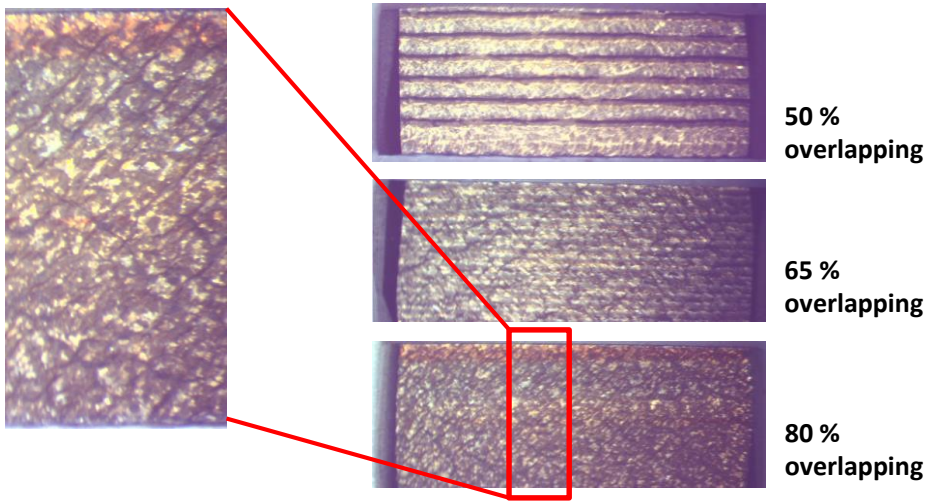
Constant scanning speed: 20mm/s	Laser power (KW)	N_2:Ar	Overlapping
1	1	10:10	50
2	1	10:10	60
3	1	10:10	65
4	1	10:10	80
5	1.15	20:20	80
6	1.4	20:20	80

Ti6Al4V Laser Nitrided at 1 KW, N_2:Ar=1:1, 60% overlapping



After 2.5 min

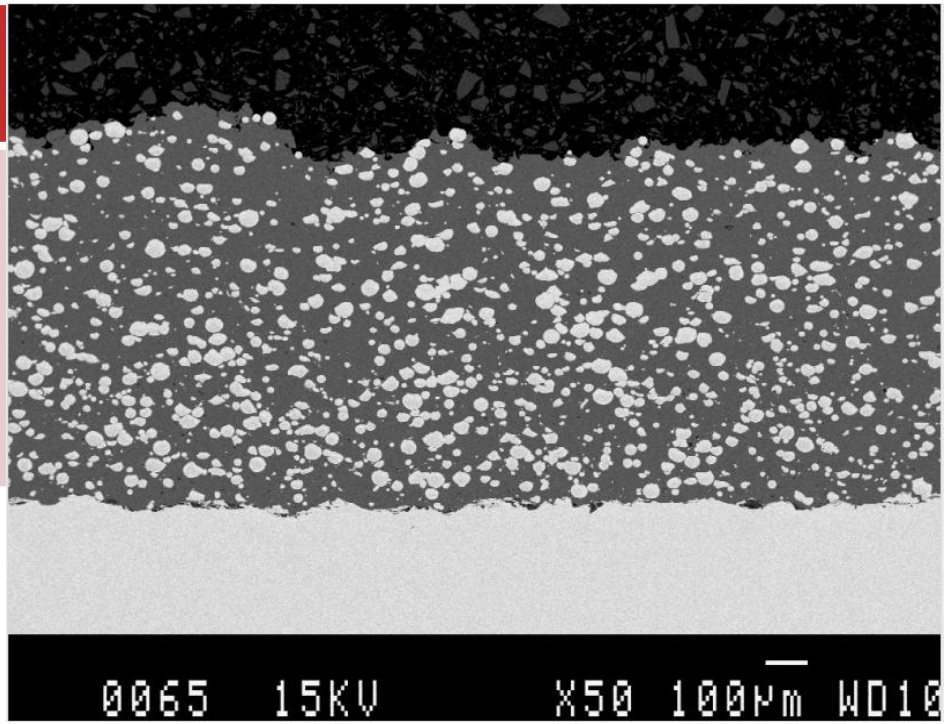
After 4.5 min



TiAl cold sprayed coating

- Spraying Titanium and Aluminium powder (Cold sprayed method)
- Heat treatment to form desired phases including TiAl and Ti_3Al

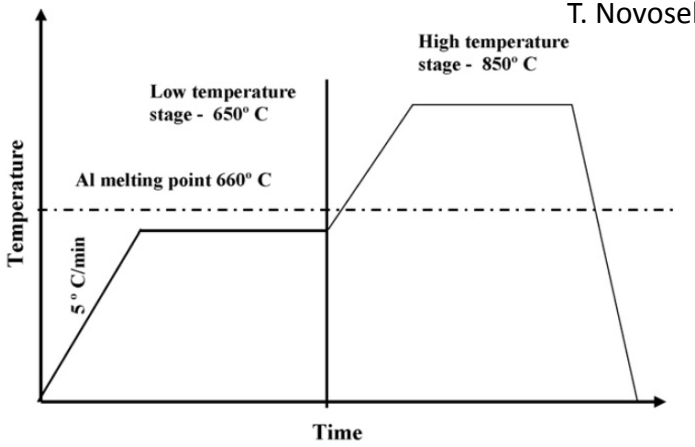
1 3 coupons	2 3 coupons
Chamber gas pressure: 3MPa Chamber temperature: 300°C Thickness: 400-500µm Spray distance: 20 mm Gun traverse speed: 200mm/sec	Chamber gas pressure: 4MPa Chamber temperature: 350°C Thickness: 700-800µm Spray distance: 20 mm Gun traverse speed: 200mm/sec



TiAl cold sprayed coating

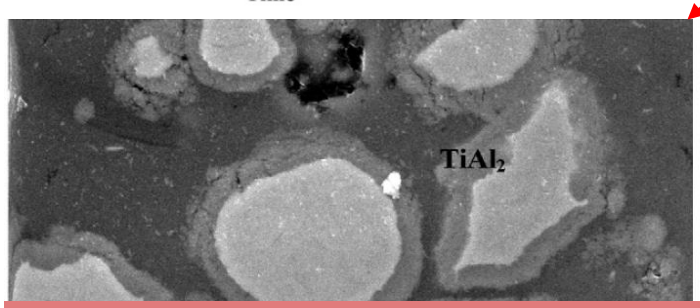
Heat treatment

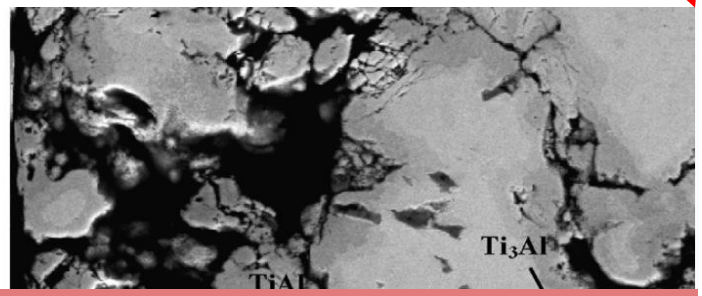
T. Novoselova, 2007



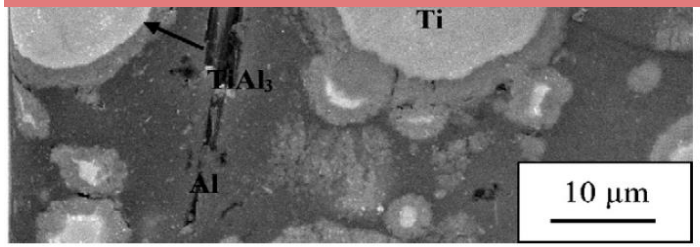
Composition derived from the full-profile quantitative analysis of the X-ray diffraction patterns

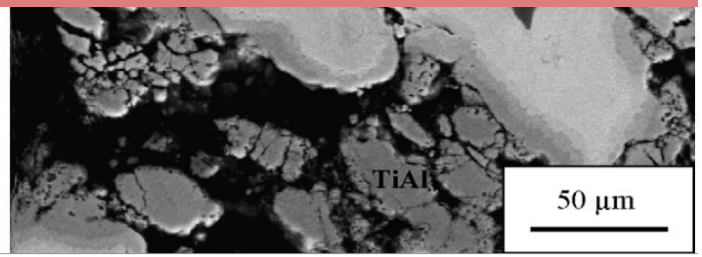
	Ti–Al deposit (wt.%)					
	3 h	6 h	16 h	3 h + 3 h	6 h + 3 h	16 h + 3 h
Ti	23	3	2	1	1	0
Al	45	16	15	–	–	–
$TiAl_3$	31	75	76	79	82	84
r-$TiAl_2$	–	1	2	3	4	3
TiAl	–	4	3	15	10	9
Ti_3Al	1	1	2	3	2	3





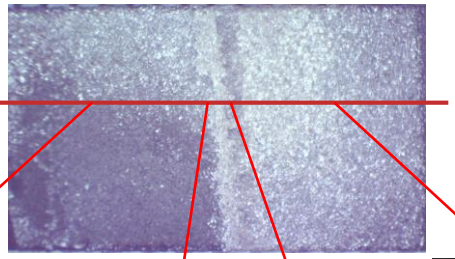
Working on different heat treatments is under process

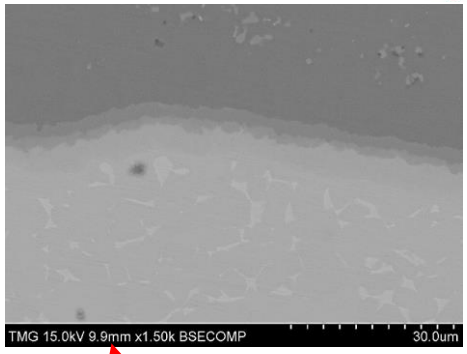


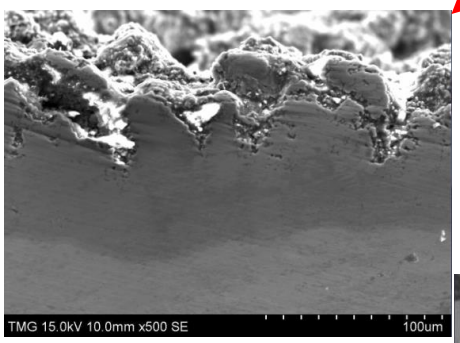


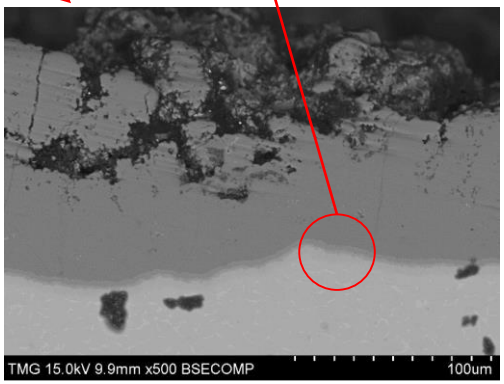
Erosion of TiAl cold sprayed coating

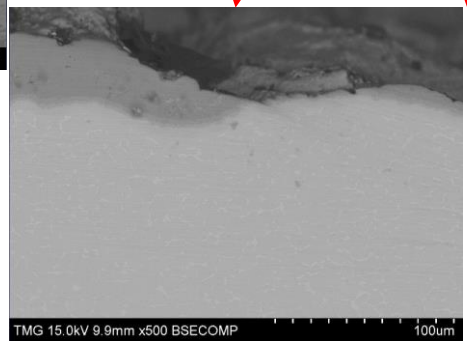
Erosion test: 400 micron nozzle, 350 m/s

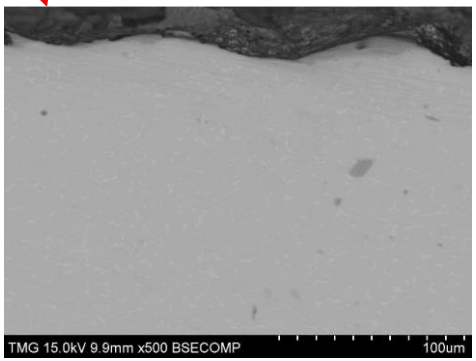




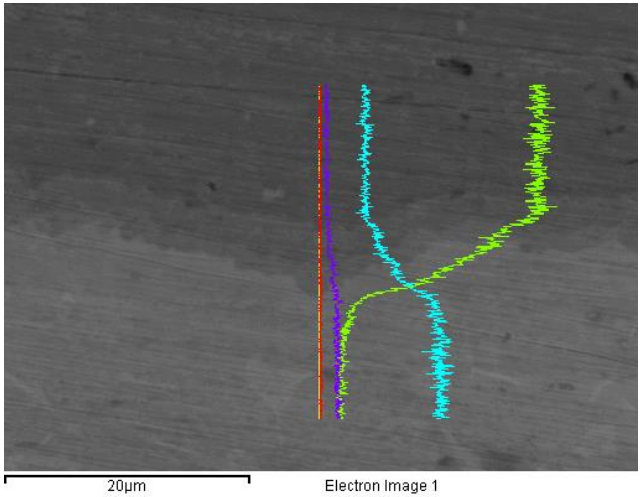


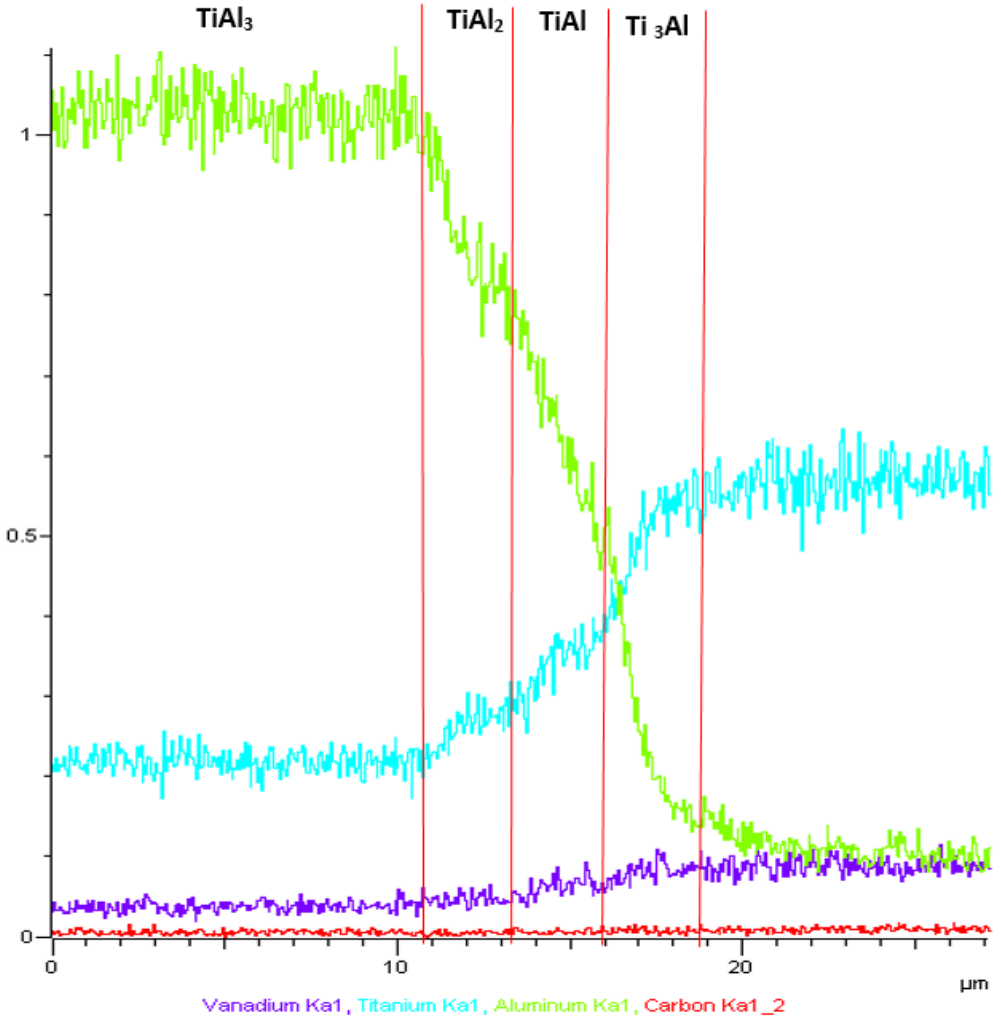






TiAl cold sprayed coating





QUESTION

THANK YOU