



SEM/EDS Surface Analysis of Dental Implant

Client	Uniqa Dental Ltd. 2 HaTsoran str, Netanya 4250602, Israel by Dmitri Psukhovskiy email: dimap@uniqa.dental
Subject of work	Dental implant: USI-3710, Lot LG1937
Time of execution	August 2023

Alla Pismenny

Operator signature

Gennady Kozyukin

Corrosion and Surface
Technologies Team Leader

signature

Daniel Safranchik

Institute director

signature



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1. Scope of Work

The Client provided The Israel Institute of Materials Manufacturing Technologies (IMT) one implant (Cat. No. USI-3710, Lot No. LF1937) to perform SEM/EDS inspection on Prisma E, Thermo Scientific, USA. The tested dental implant was provided in its complete and final packaging.

According to the client's statement: The tested implant Internal Hex RP (RP means Regular platform); The provided tested product is a final product after undergone the entire processes and its final packaging; Dental implant are provided with Pure & Porous (P&P) surface treatment – which consists of Hydroxyapatite and Calcium Phosphates; In addition, according to the client's statement and as detailed in the provided Inspection Certificate to EN 10204/3.1, No: 1210102866000010 01 (included in the report appendix 1), the implant material designation is “Ti6AL4V-ELI TITANIUM ALLOY FOR IMPLANTS,” with stated customer specification ISO 5832-3 and ASTM F136-13. It should be noted that the correlation between the certificate and the specific implant specification is based solely on the information provided by the client and has not been independently verified or assessed within the scope of this report.

The BSE (Back Scattered Electrons) images were used to emphasize contamination. EDS chemical composition results give an identification of impurities' elemental compositions, meaning it is a qualitative measurement only. EDS table results in weight percent (wt. %) were added according to customer's request.

Table 1: Description of Dental implant.

IMT No.	Cat. No.	Lot No.	Client Description	Qty
4140/1	USI-3710	LG1937	UH8 Implant Pure&Porous D3.75 L10 Internal Hex RP	1

2. SEM/EDS results

2.1. 4140/1 – Cat.No. USI-3710, Lot No. LF1937

A general view is shown in Fig 1a.

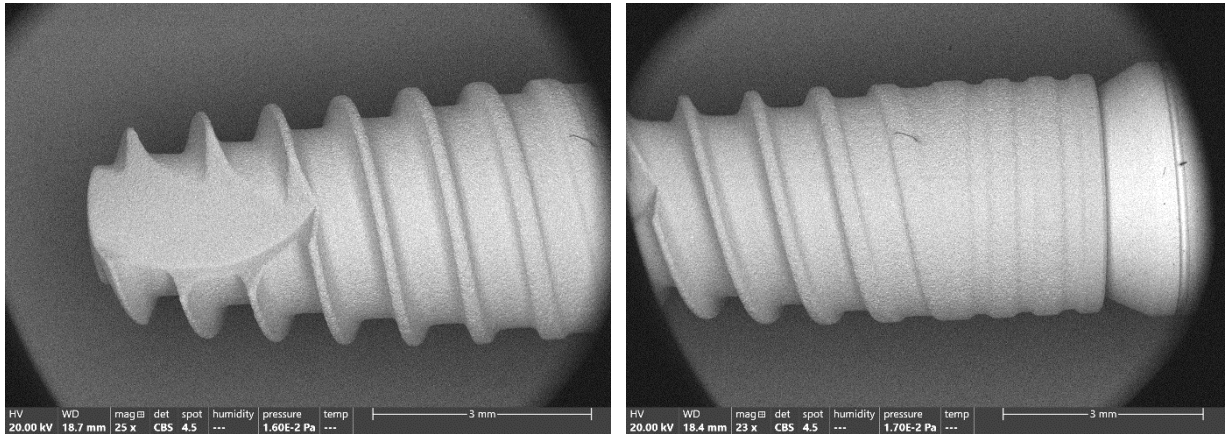


Fig 1a: General view.

An area 1 at x400 magnification is shown in Fig 1b.

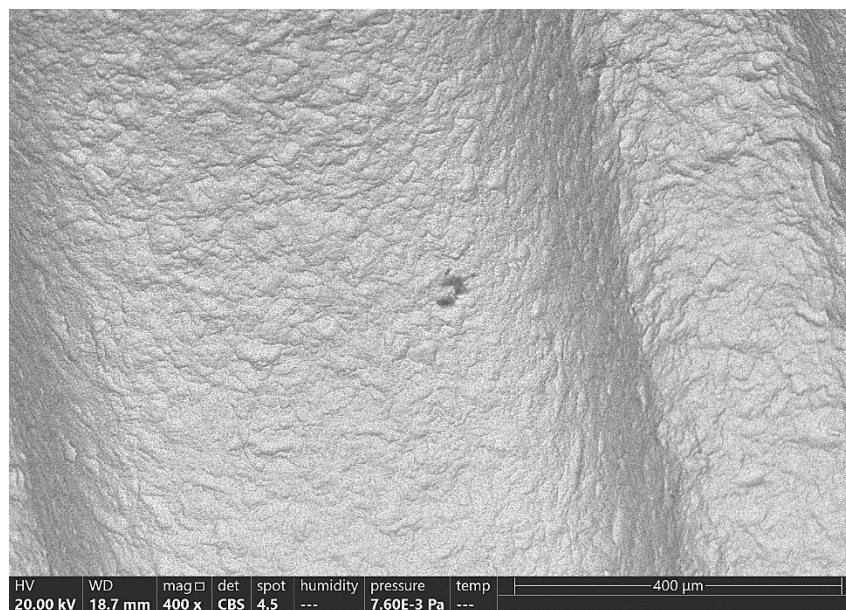


Fig 1b: An area 1 at x400 magnification.

A BSE image, indicating the locations of EDS analysis, is shown in Fig. 1c. The EDS spectrum from a general area in Fig. 1d shows the composition of Ti-based alloy containing Aluminum (Al), Vanadium (V), C (carbon), O (oxygen). The EDS spectrum from spot containing C, O is shown in Fig. 1e.

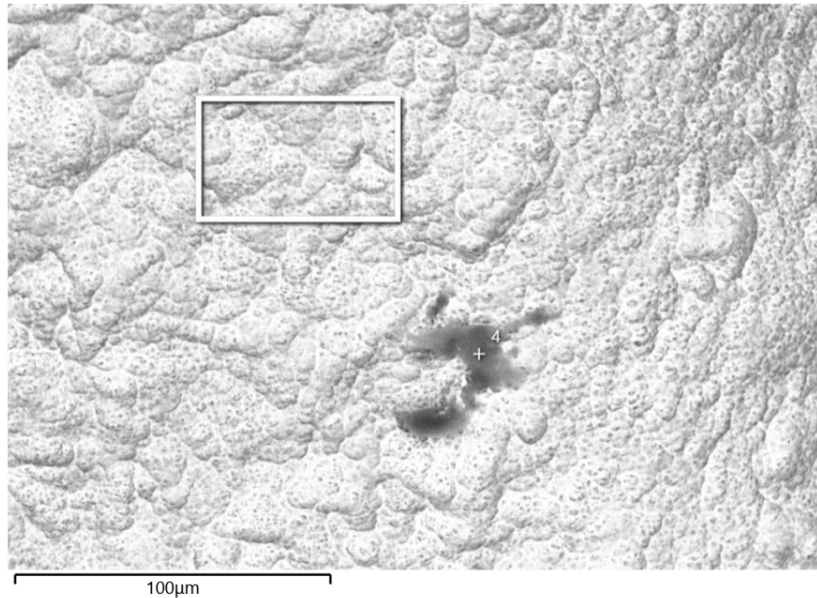
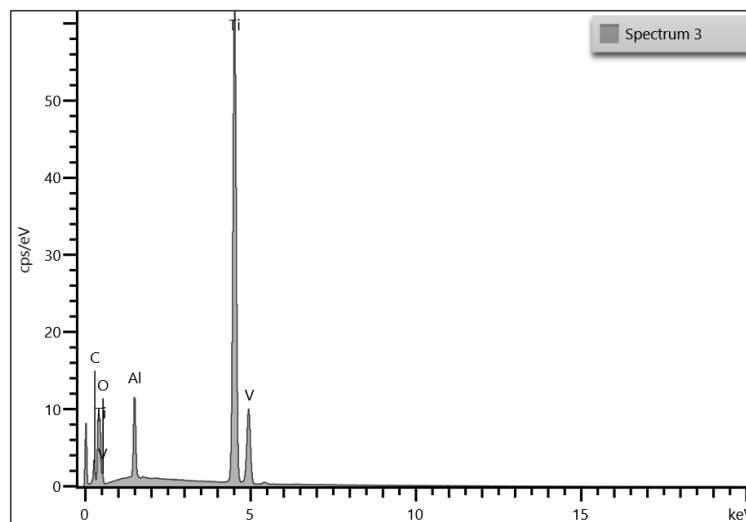
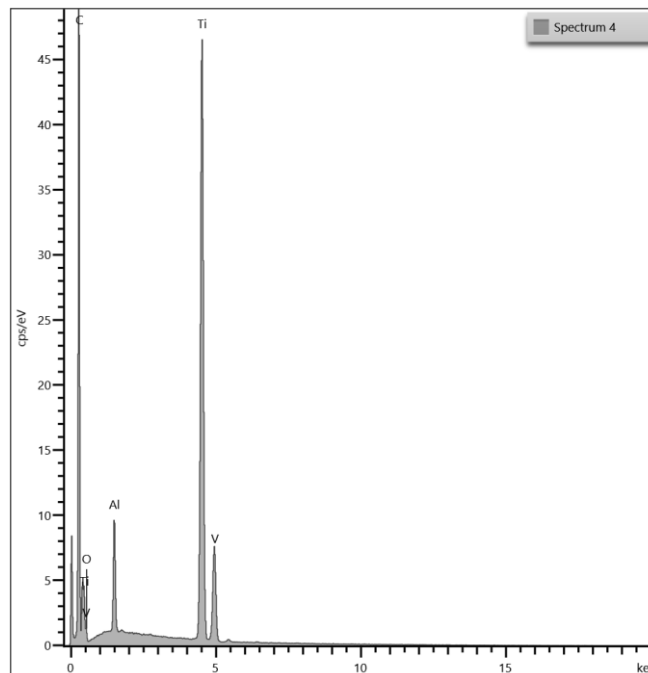


Fig 1c: BSE image, indicating the locations of EDS analysis.



Spectrum, wt. %	Al	Ti	V	C	O
Spectrum 3	6.51	77.88	3.39	6.83	5.36

Fig 1d: EDS spectrum from a general area.



Spectrum, wt.%	Al	Ti	V	C	O
Spectrum 4	2.90	39.81	1.75	53.36	2.19

Fig 1e: EDS spectrum from spot.

Area 2 at x400 magnification is shown in Fig. 1f.

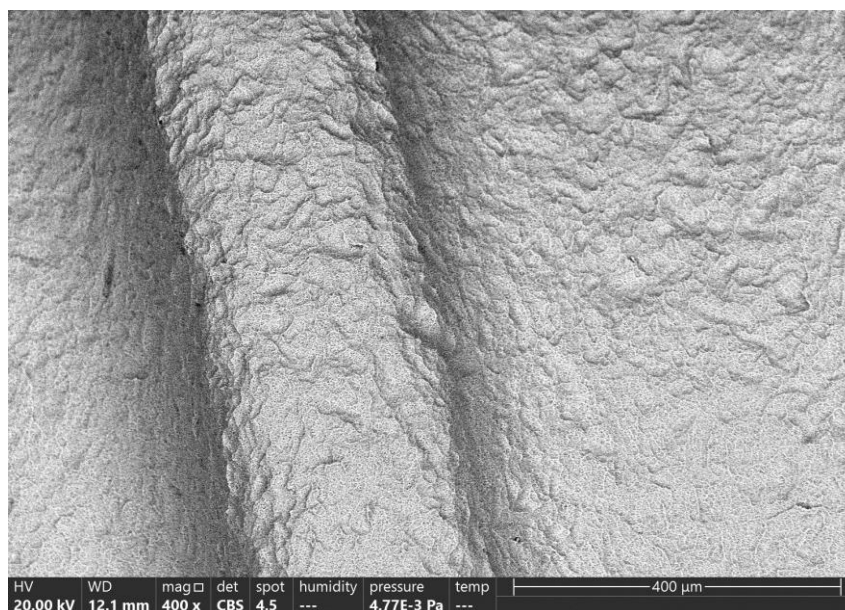


Fig 1f: Area 2 at x400 magnification.

A BSE image, indicating the locations of EDS analysis, is shown in Fig. 1g. The EDS spectrum from a general area is shown in Fig. 1h.

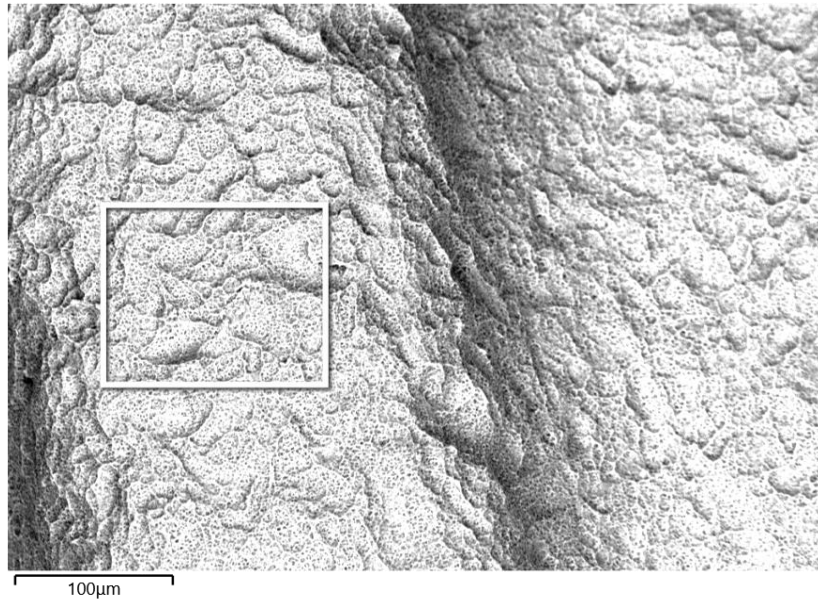
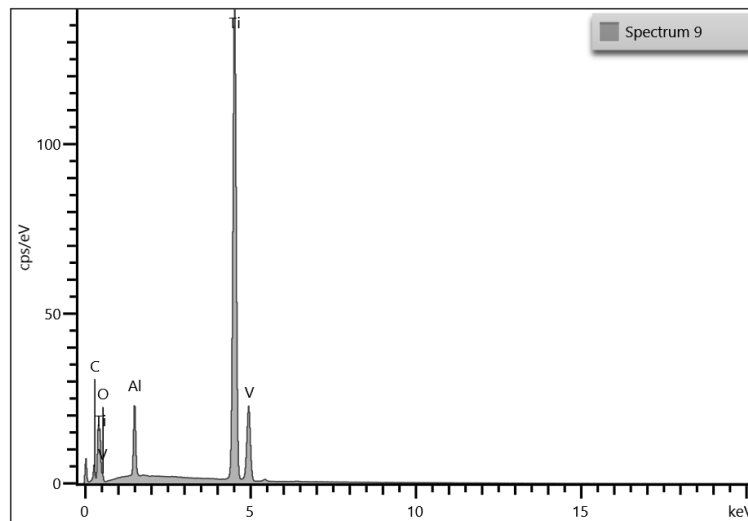


Fig 1g: BSE image, indicating the locations of EDS analysis.



Spectrum, wt. %	Al	Ti	V	C	O
Spectrum 9	6.06	80.88	3.51	4.85	4.69

Fig 1h: EDS spectrum from general area.

Area 3 at x400 magnification is shown in Fig 1i.

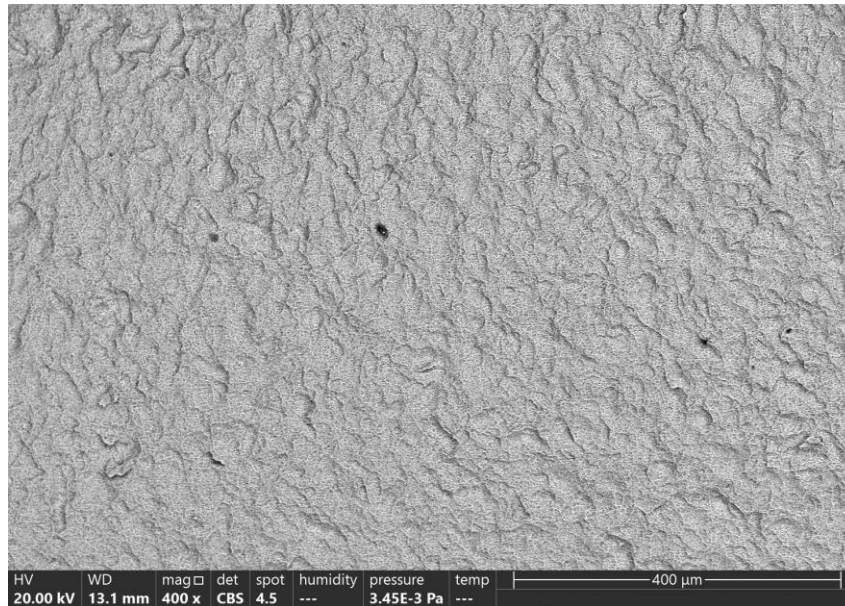


Fig 1i: Area 3 area at x400 magnification.

A BSE image, indicating the locations of EDS analysis, is shown in Fig. 1j. The EDS spectrum from a particle containing C, Si, Ca, Zn, Cl, S, O is shown in Fig. 1k.

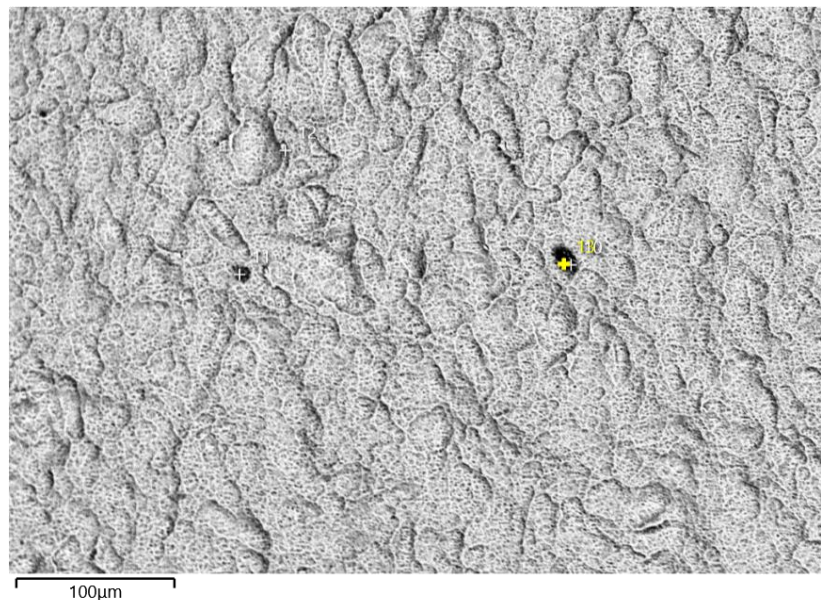
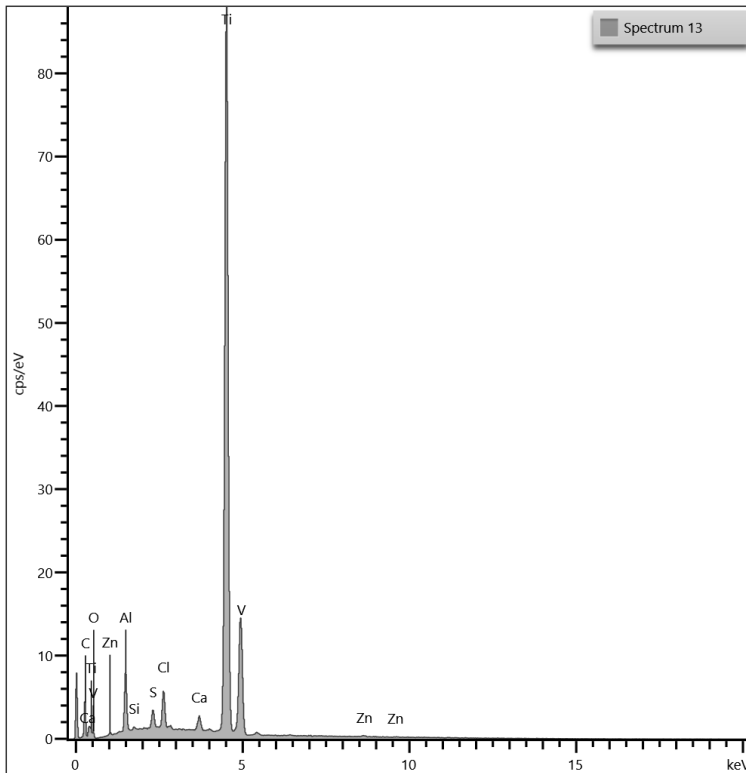


Fig 1j: BSE image, indicating the locations of EDS analysis.



Spectrum 13, wt.%	Element	Weight %
	C	8.91
	O	2.71
	Al	3.07
	Si	0.13
	S	0.81
	Cl	1.83
	Ca	0.86
	Ti	77.62
	V	3.53
	Zn	0.53

***Fig 1k: EDS spectrum from particle.

Area 4 at x400 magnification is shown in Fig 1l.

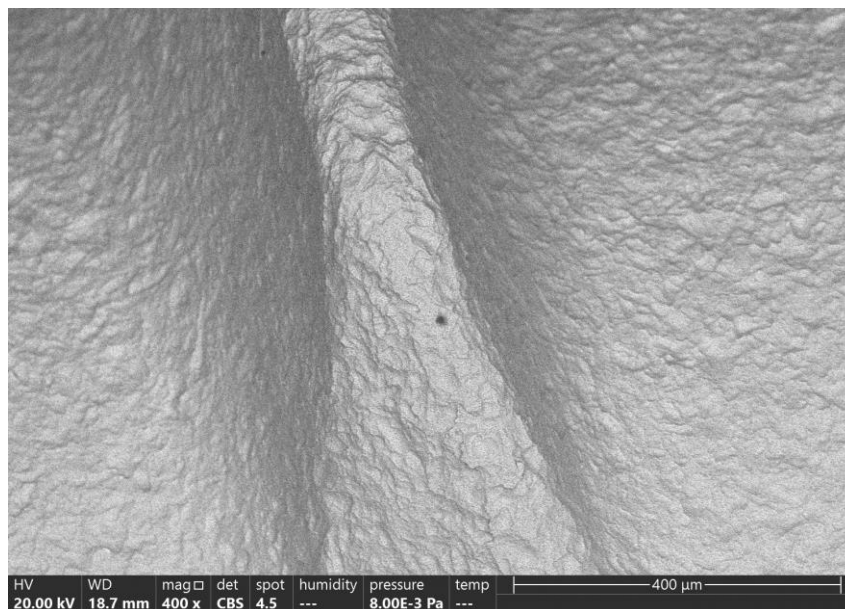


Fig 1l: Area 4 at x400 magnification.

A BSE image, indicating the locations of EDS analysis, is shown in Fig. 1m. The EDS spectrum from a spot containing C, Na, Ca, S, Cl, O is shown in Fig. 1n. The EDS spectrum from a general area is shown in Fig. 1o.

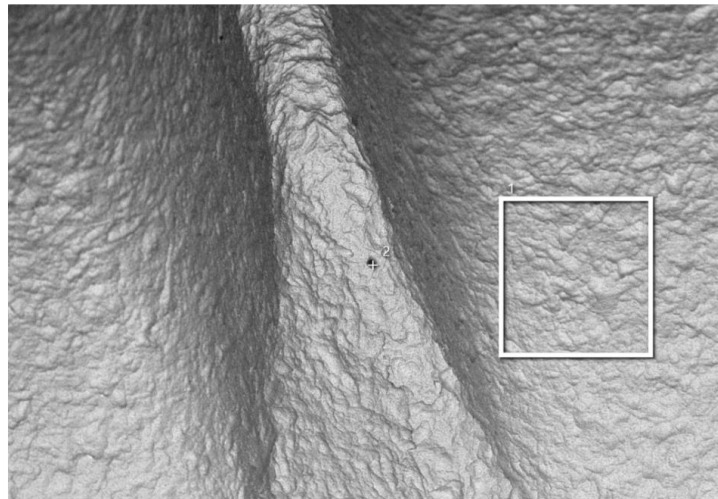
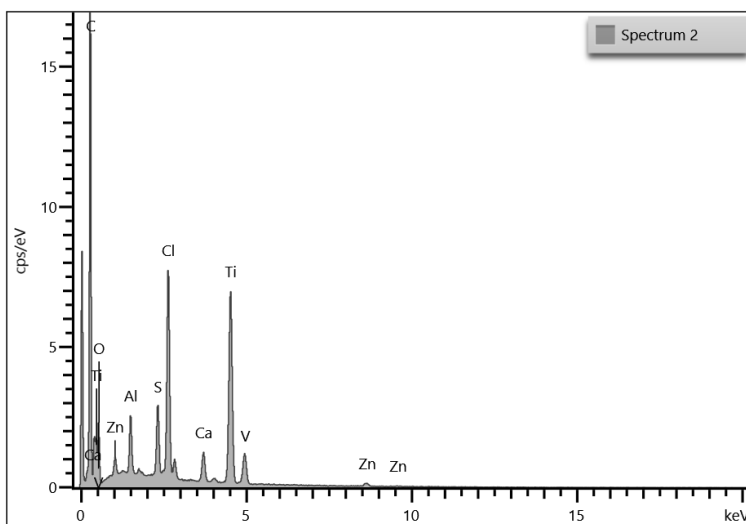
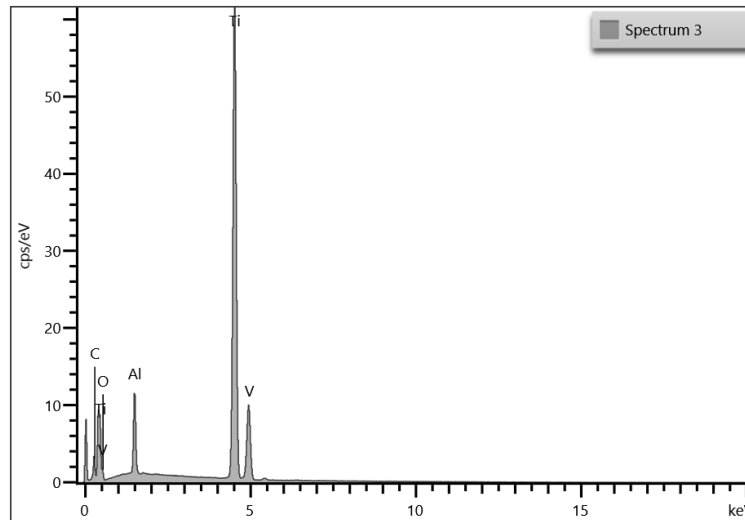


Fig 1m: BSE image, indicating the locations of EDS analysis.



Spectrum 2, wt.%	Element	wt. %
	C	64.92
	O	10.30
	Al	1.32
	S	1.78
	Cl	6.02
	Ca	1.24
	Ti	12.87
	V	0.59
	Zn	0.95

Fig 1n: EDS spectrum from spot.



Spectrum, wt. %	Al	Ti	V	C	O
Spectrum 1	6.51	77.88	3.39	6.83	5.39

Fig 1o: EDS spectrum from general area.

A surface morphology of small dimples with large cavities was observed on the tooth crest and root as shown in Fig. 2. Insufficient etching areas were observed on the surface of the tooth crest.

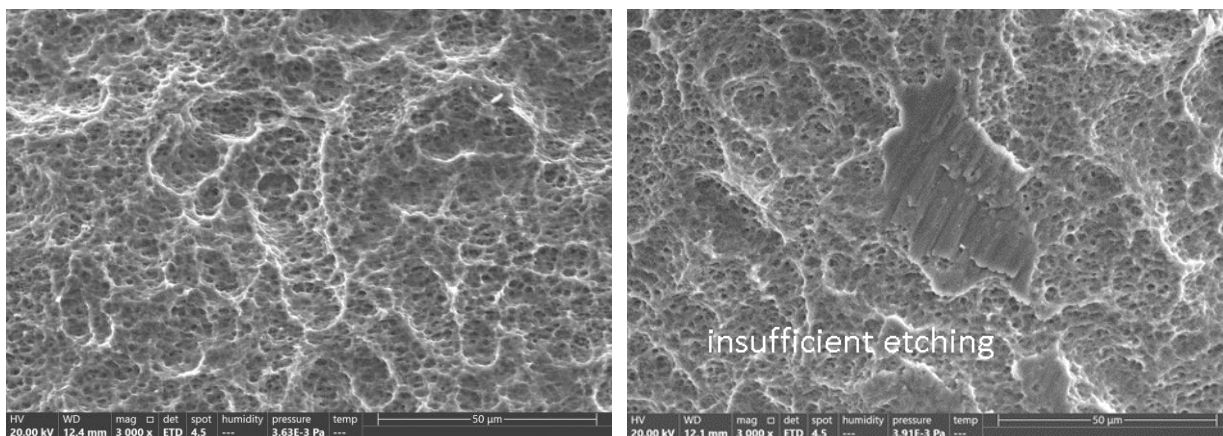


Fig 2: Surface morphology at the tooth root (on the left) and crest (on the right).



Summary

4140/1 – Cat.No. USI-3710, Lot No. LF1937

- A few carbon-based spots were observed on the implant surface.
- A few carbon-based spots containing C, Ca, Zn, S, Cl, O were observed on the implant surface.
- An EDS spectra from a general area in Fig. 1d,1h,1o show the composition of Ti-based alloy containing Aluminum (Al), Vanadium (V), C (carbon) and O (oxygen).
- A surface morphology of small dimples with large cavities was observed at the tooth of the implant. Insufficient etching areas were observed on the surface of the tooth crest.

End of the report



Appendix 1: Certificate to EN 10204/3.1, No: 1210102866000010 01

INSPECTION CERTIFICATE TO EN 10204/3.1
ABNAHMEPRÜFZEUGNIS EN 10204/3.1
CERTIFICAT DE RECEPTION EN 10204/3.1

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Titanium Ø5

Zapp Precision Metals GmbH, 58239 Schwerte
R.M. Industrial Services Ltd.
10 Hahagana St.
6039730 OR YEHUDA
ISRAEL

Certificate No./Attest-Nr. 1210102866000010 01

Date/Datum 25.08.2022 Page/Seite/Page 1/2

Customer PO# Kunden-Bestell-Nr. / No. de commande	A1/008158 of/vom/du 24.08.2022	Delivery Note Lieferschein-Nr. / Bon de livraison	1210102866 Pos 10
Customer Part No. Kunden-Material-Nr. / Votre No. d'article	2ZA TI 6AL D5.0	Contact Kontakt	Veit Schlaus Tel. +49 02304 79-140
Customer Specification Kunden-Spezifikationen / Spécification de client	ISO 5832-3: 2016-10-15 ; ASTM F136-13		
Customer No. Kundennr. / Code client	646899		
Sales Order No. Auftragsnr./No. de commande	1202037714		
Material No. Materialnr./No. d'article	5501408		
Material Designation Bezeichnung / Désignation	TI 6AL 4V-ELI TITANIUM ALLOY FOR IMPLANTS		
Grade / Alloy	ERGITAN 3.7165 MG		
Finish	drawn, annealed, straightened, stress relieved annealed, ground, polished		
Diameter (mm)	5.0000 mm		
Diameter tolerance	-0.0080 mm / 0.0000 mm		
Bar length (mm)	3,000.000 mm		
Bar length tolerance	0.000 mm / 50.000 mm		
Chemical Composition (%) Chemische Zusammensetzung / Composition chimique		Heat No. Schmelzennr. / No. de coulée	00W1F06
Melting Process: Double melted, last melt VAR Erschmelzungsart / Mode d'élaboration			
Actual	C 0.010	N 0.0100	O 0.1100
	Fe 0.140	Al 6.05	V 3.94
		TI bal.	Σ Trans 979.0

מיקרו זיקה עיבוד שבבי
ממוחשב (1997) בע"מ
-- מאושר --
שם: [Signature]
חתימה:
תאריך: 7/9/22

AWE / A. HENNIG
Acceptance / Inspection representative
Abnahme / Abn. Beaufragter
Contrôle / Contrôleur

+49 2304 79-7162
Phone
Telefon
Téléphone

This certificate has been issued by computer and is
valid without signature acc. to EN 10204 p.5.

Zapp Precision Metals GmbH | Leitmather Str 69 | D-58239 Schwerte | Germany Phone+49 2304 79-0 | Fax+49 2304 79-432 | www.zapp.com
Sitz: Schwerte | Amtsgericht: Hagen HRB 4715 | USt-Id.Nr.: DE 124 896 895 | Geschäftsführer: Dr Stefan Seng, Gerald Zwickel, Edo Ollermann, Britta Van Beurden.





INSPECTION CERTIFICATE TO EN 10204/3.1
ABNAHMEPRÜFZEUGNIS EN 10204/3.1
CERTIFICAT DE RECEPTION EN 10204/3.1

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Zapp Precision Metals GmbH, 58239 Schwerte

R.M. Industrial Services Ltd.
10 Hahagana St.
6039730 OR YEHUDA
ISRAEL

Certificate No./Attest-Nr. 1210102300000010 01

Date/Datum 25.08.2022 Page/Seite/Page 2/2

Production Lot 5821111
Produktionslos / Unité de production
Weight
Gewicht / Poids

Inspection Lot 020000438930 / 000001
Prüflot / Probenlot / Unité d'inspection
99.800 KG

Pack. Unit
Packstücke / No. de caisse
Inspection result
Prüfergebnis / Résultats d'examen

M125384001

	Target (min)	Target (max)	Actual (min)	Actual (max)
Tensile Strength (MPa)	900	1500	1068	1118
Yield Strength 0.2 (MPa)	795		847	916
Elongation A4d (%)	10.0		16.5	19.7
Elongation A5 (%)	10.0		15.3	16.8
Tensile Strength (ksi)			154.9	162.1
Yield Strength 0.2 (ksi)			122.8	132.8
Elongation A5d gage length(mm)	15.0	99.0	25.0	25.0
Elongation A4d gage length(mm)	15.0	99.0	20.0	20.0
Reduction of area Z (%)	25.0		52.7	53.4
Average Roughness Ra (µm)		0.500	0.401	0.489
Hydrogen content at finish %		0.0120	0.0031	0.0032

Microstructure

No alpha-case at 100x magnification.

Microstruct. ISO 20160 (Titan.)

acc. to ETTC 2 / ISO 20160: A1
acc. to ETTC 2 / ISO 20160: A2

Sizes and Quality identification test examined and in order.
Surface visual inspection at finish: without objection.
In compliance with the conditions mentioned in the acknowledgement of order.

AWE / A. HENNIG

Acceptance / Inspection representative
Abnahme / Abn. Beauftragter
Contrôle / Contrôleur

+49 2304 79-7162

Phone
Telefon
Téléphone

This certificate has been issued by computer and is
valid without signature acc. to EN 10204 p.5.

Zapp Precision Metals GmbH | Leitwälder Str. 69 | D-58239 Schwerte | Germany Phone +49 2304 79-0 | Fax +49 2304 79-432 | www.zapp.com
Skz: Schwerte | Anlagenl. Hagen 1400 4715 | URN-AZAR: DE 134 998 890 | Geschäftsführer: Dr. Stefan Beng, Gerald Zwickel, Edo Obermann, Britta Van Beurden.

