



Corrosion and Surface Technologies Lab.
R&D and services
December 2019

The Israel Institute of Metals (IIM)

Founded to support quality and development in metal related industries. Fully owned by the Technion Research and Development foundation (TRDF).

Research & Services



Industrial services under ISO 17020 and testing under ISO 17025



3 main research laboratories: **Corrosion & Surface Technologies**, **Foundry (Production technologies)** and **Metallurgical**



Additive Manufacturing and TechMed R&D Centers

Medium/long-term activities

Applied research for the industry

National and multilateral funded R&D projects

Commercialization and industrialization

Supervision of undergraduate and graduate students

Dissemination and exploitation

Short-term activities

Advisory for the industry

Testing according to standards

Failure analysis

On-site inspection services

Organization of events (creating an eco-system)

Innovations in surface technologies

- Advanced coatings.
- Chemical and electrochemical finishing technologies.
- Unique testing equipment.
- Special surface solutions for the medical device sector.
- Solutions for additive manufacturing.



Case study

Development of an hydrophilic coating for Al6061

Image of water drop on Al6061 surface after hydrophilic coating

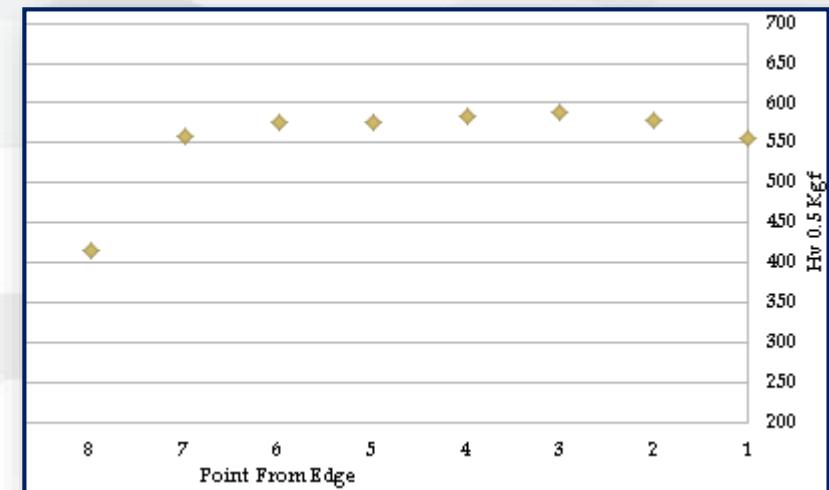
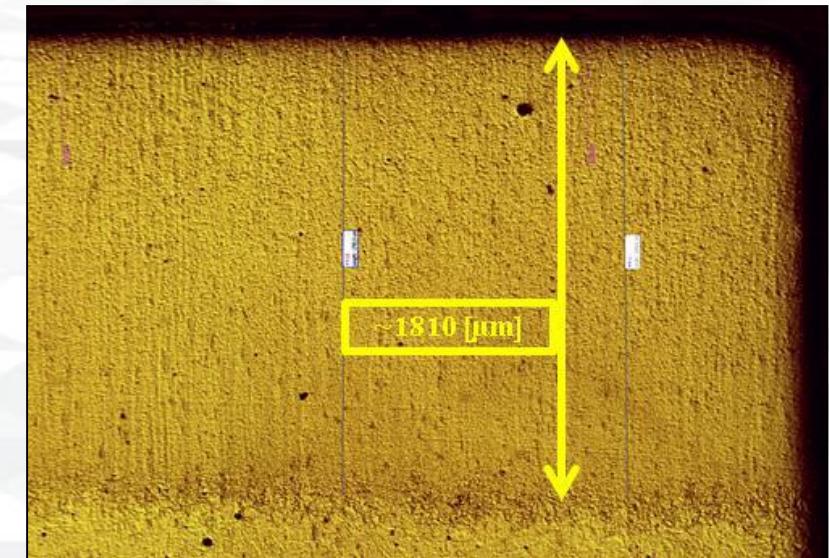
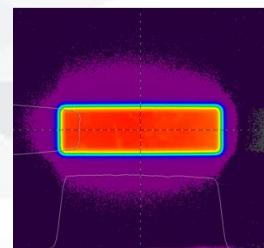


Image of water drop on Al6061 surface before coating



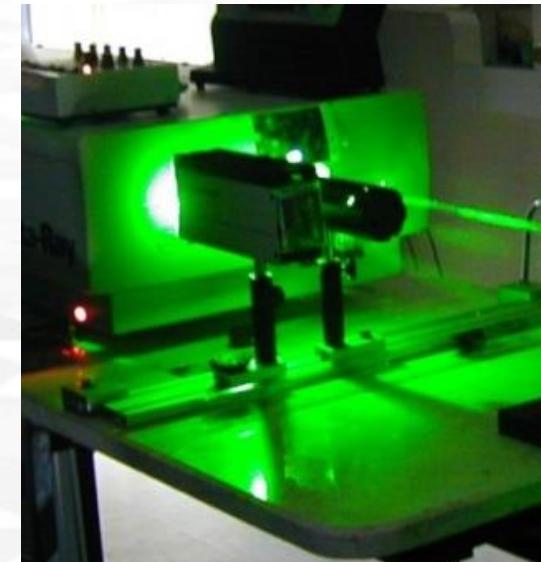
Case study

Laser hardening of tool steels using HPDL



Case study

Pre-adhesion laser treatment for improved bonding of composite materials

**System:**

Pulsed mode Nd:YAG laser Quanta – Ray PRO-290-10 Spectra-Physics.

Method:

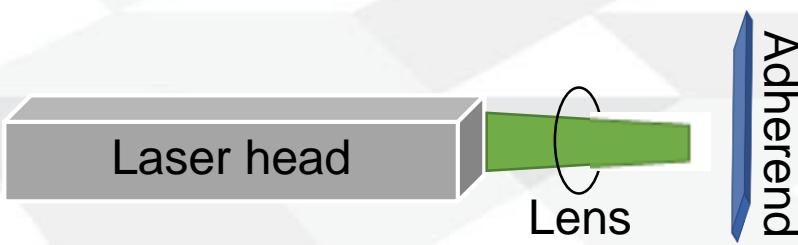
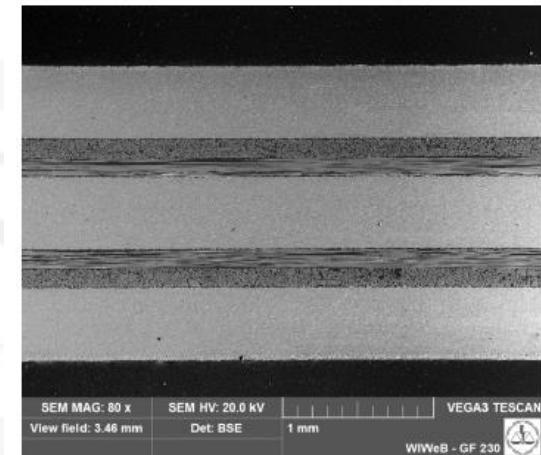
Surface treatment to achieve strong and durable bonds, based on

Cleaning

Chemical activation

Morphological changes (texturizing/roughening)

Surface Ablation



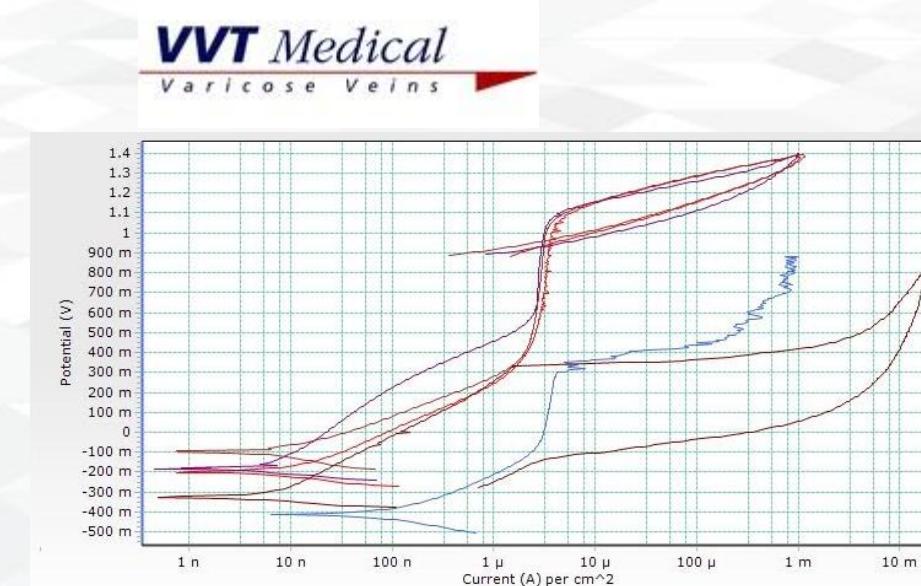
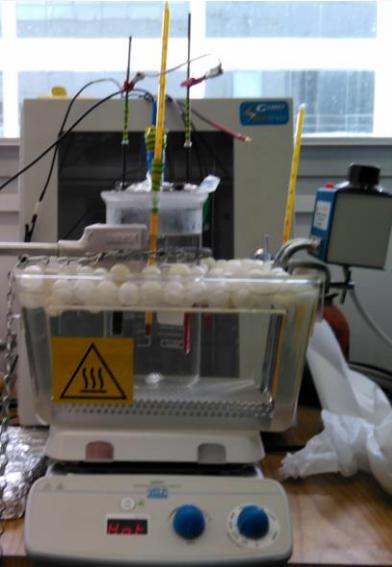
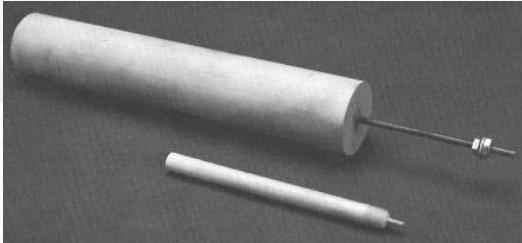
Environmental Friendly



Case study

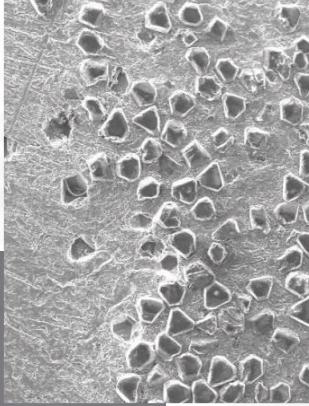
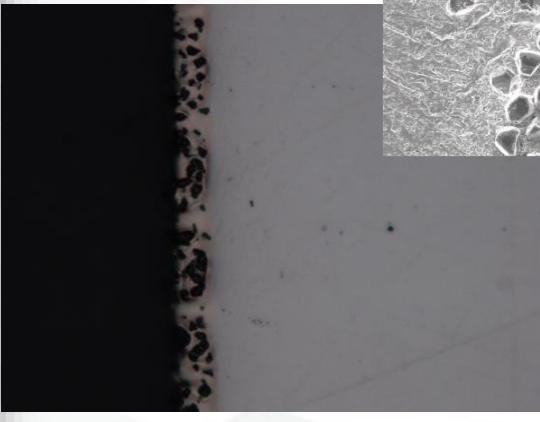
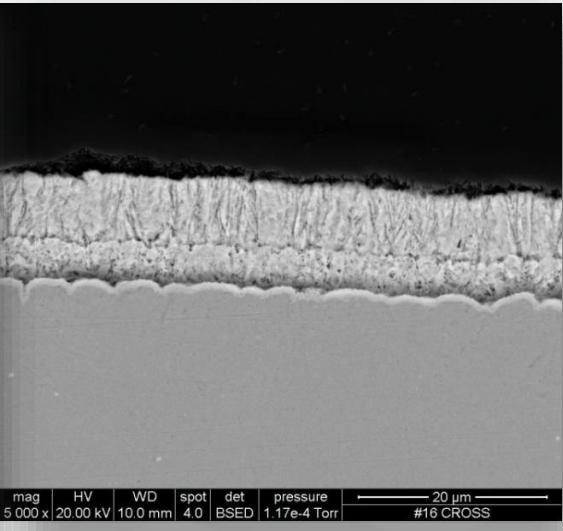
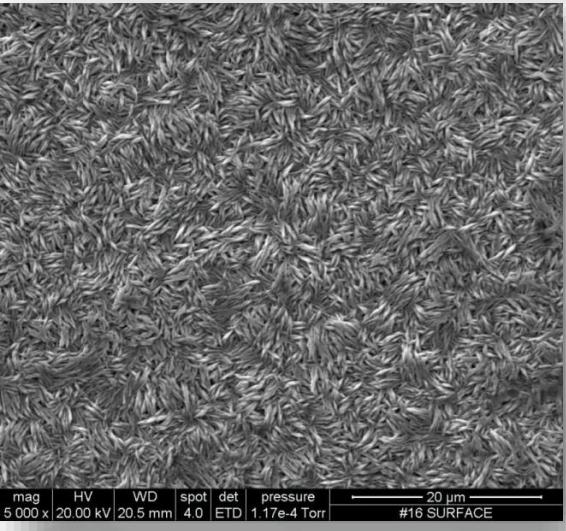
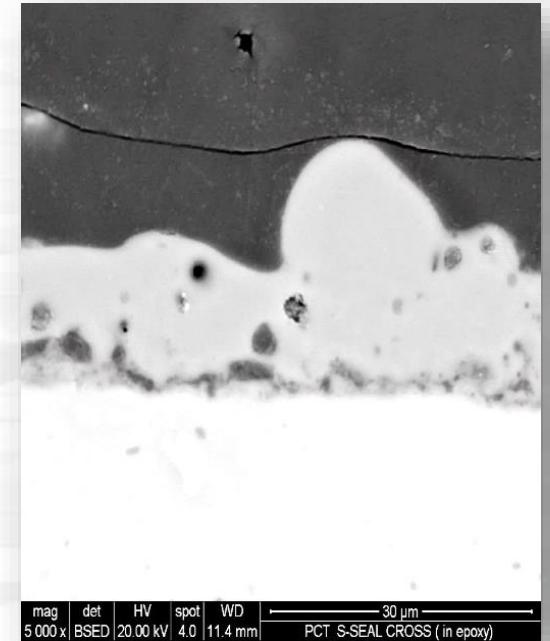


Different examples of short-term projects



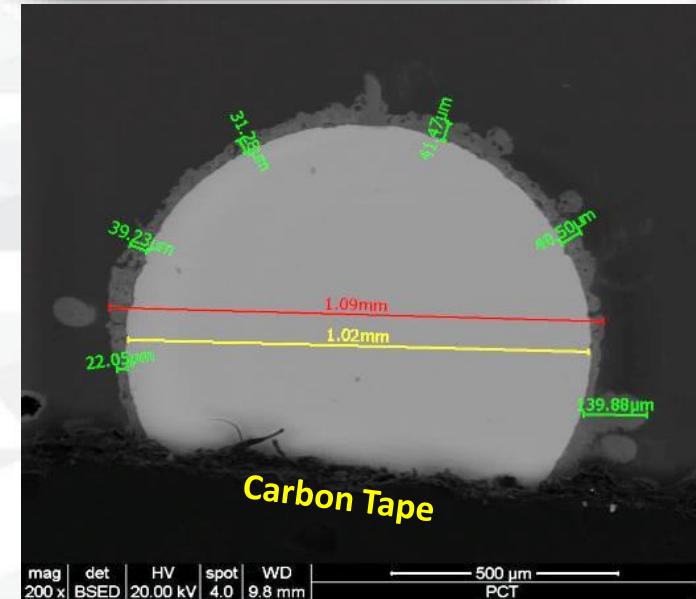
Rapid Electrochemical Assessment of Paint (REAP)

Research & Development - Coatings



Zn-polymer coatings as potential for Cd replacement

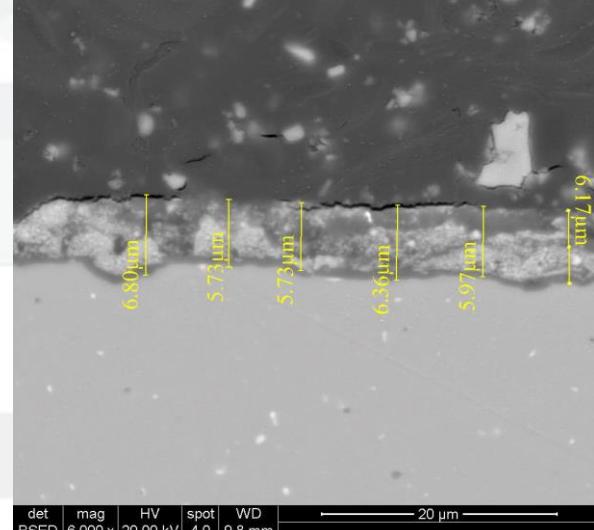
Ni-P with diamonds



Ceramic coatings on metals (MAO)



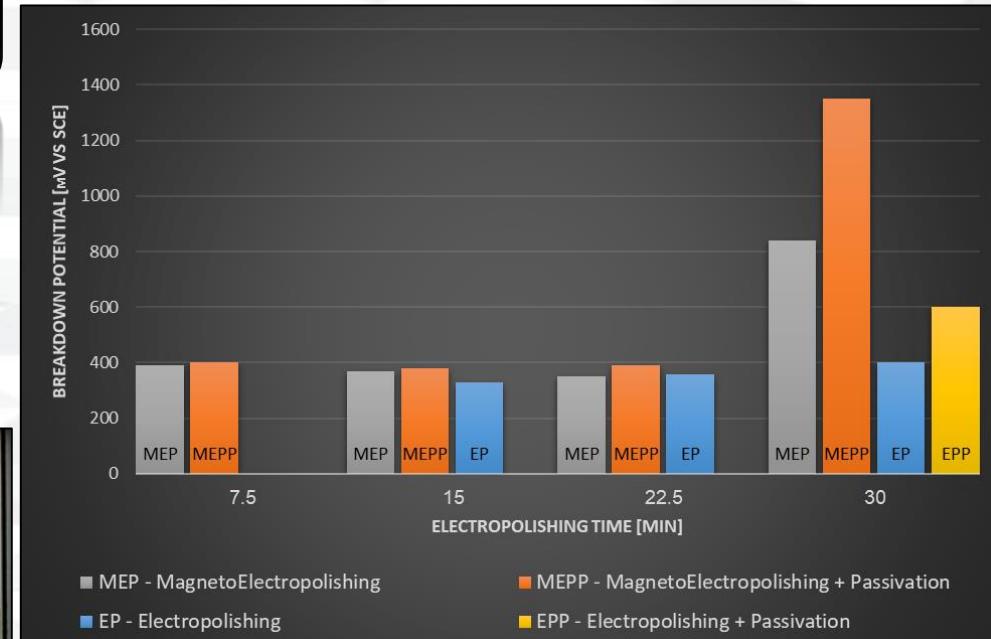
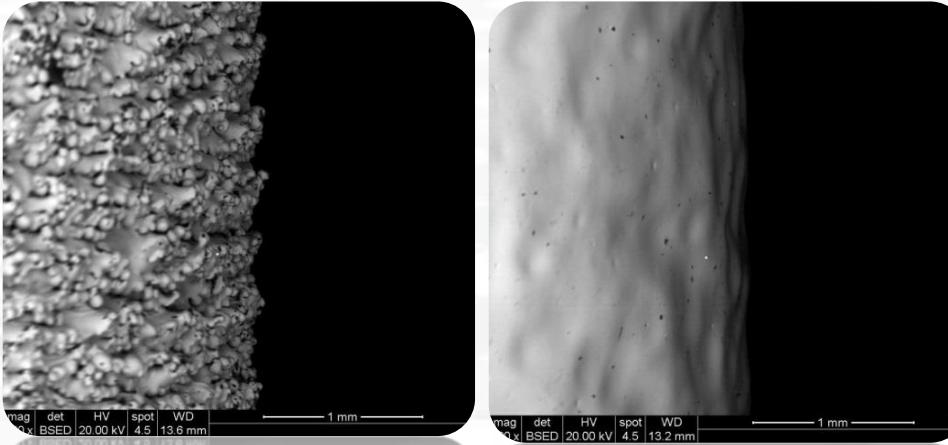
Electrophoretic deposition of ceramic coatings



Research & Development – Advanced polishing techniques

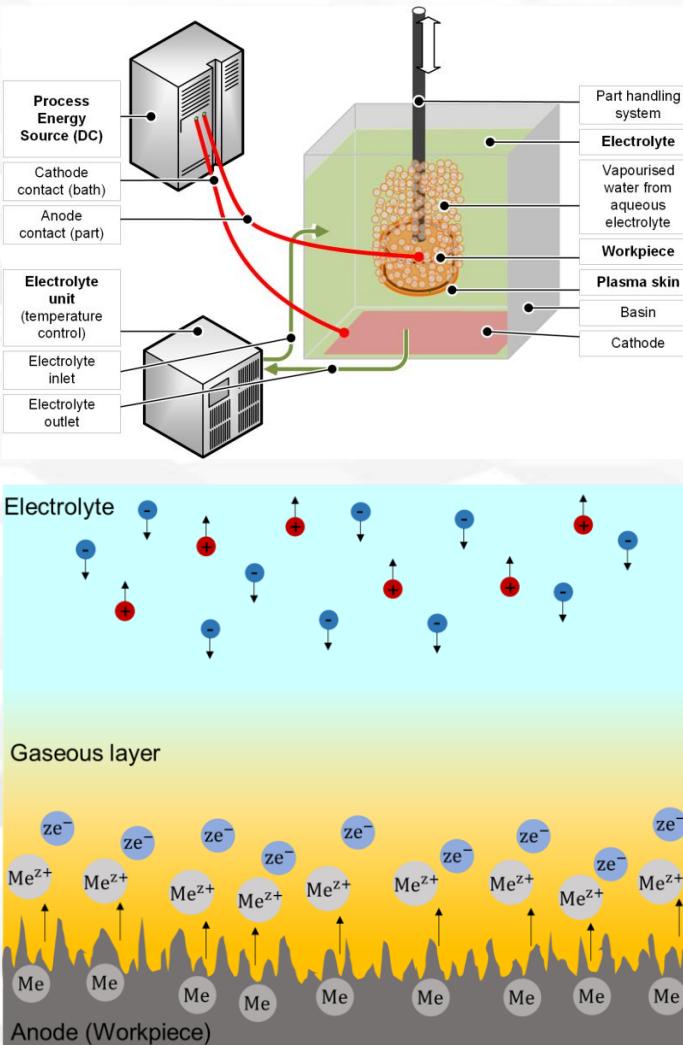


Electro-chemical
polishing (EP)



Magnetic-assisted EP

Research & Development – Advanced polishing techniques



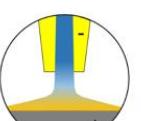
PEP process (St.St.316L/316L VAR)

Plasma EP (PEP)

Research & Development – Advanced polishing techniques



TECHNISCHE UNIVERSITÄT
CHEMNITZ



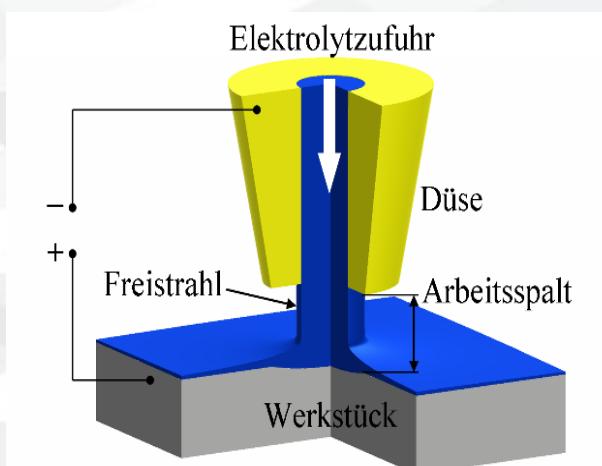
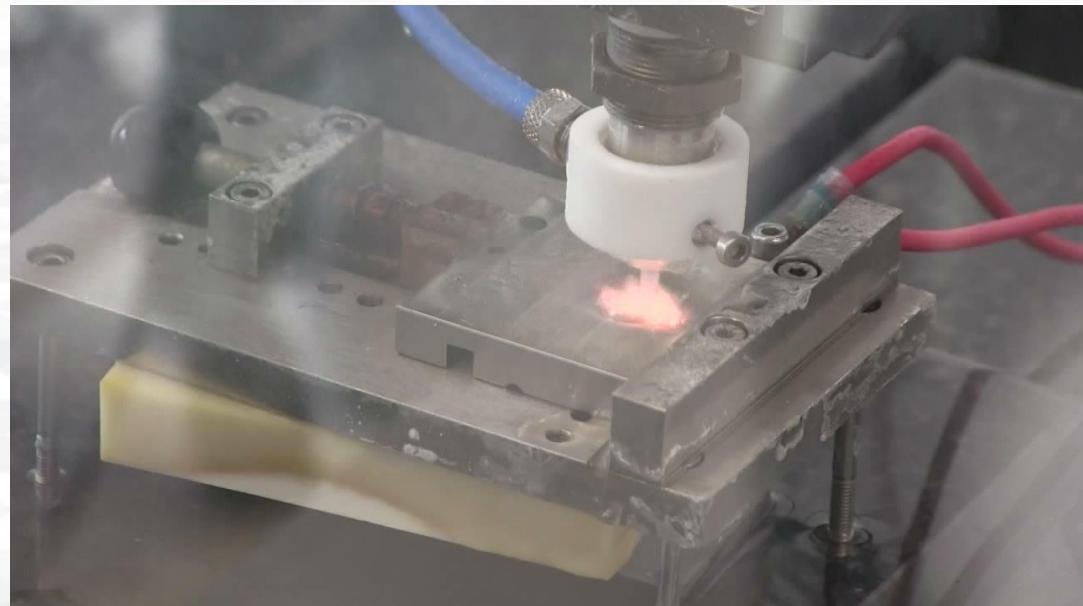
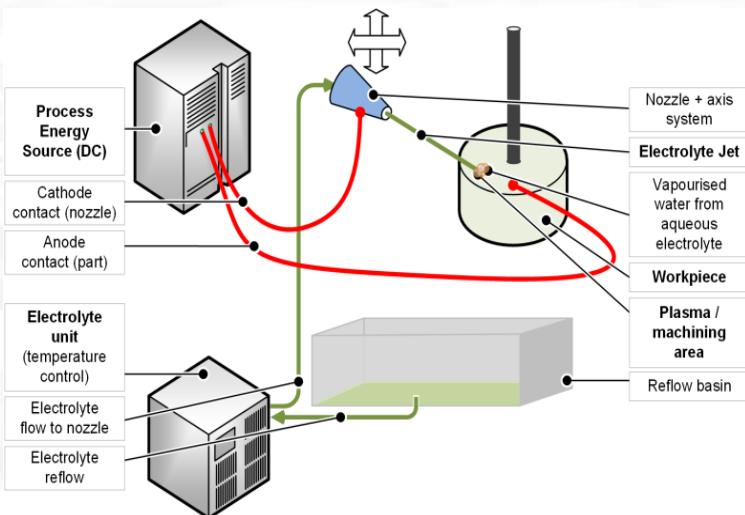
Leukhardt
Schaltanlagen Systemtechnik

BECKMANN INSTITUT
für Technologieentwicklung e.V.

TECHNION
Israel Institute
of Technology

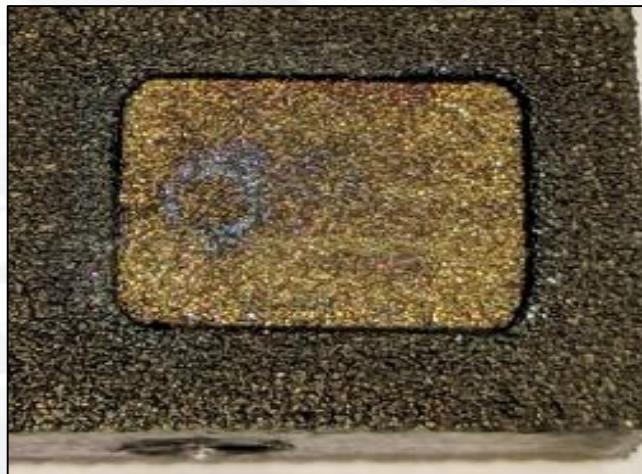
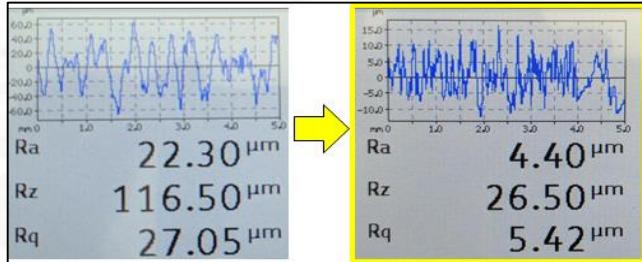


רשות החדשנות
Israel Innovation
Authority

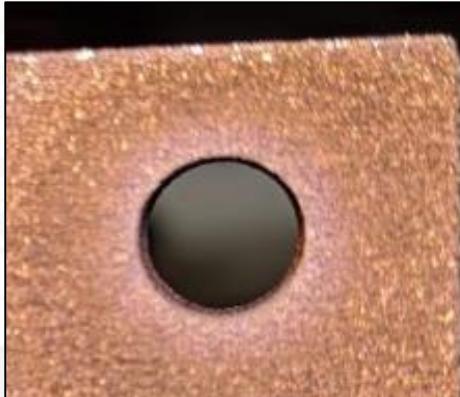


Local PEP (Jet-PEP)

Research & Development – Advanced finishing techniques



AMed (EBM) Ti-6Al-4V localized polishing



AMed Ti-6Al-4V drilling



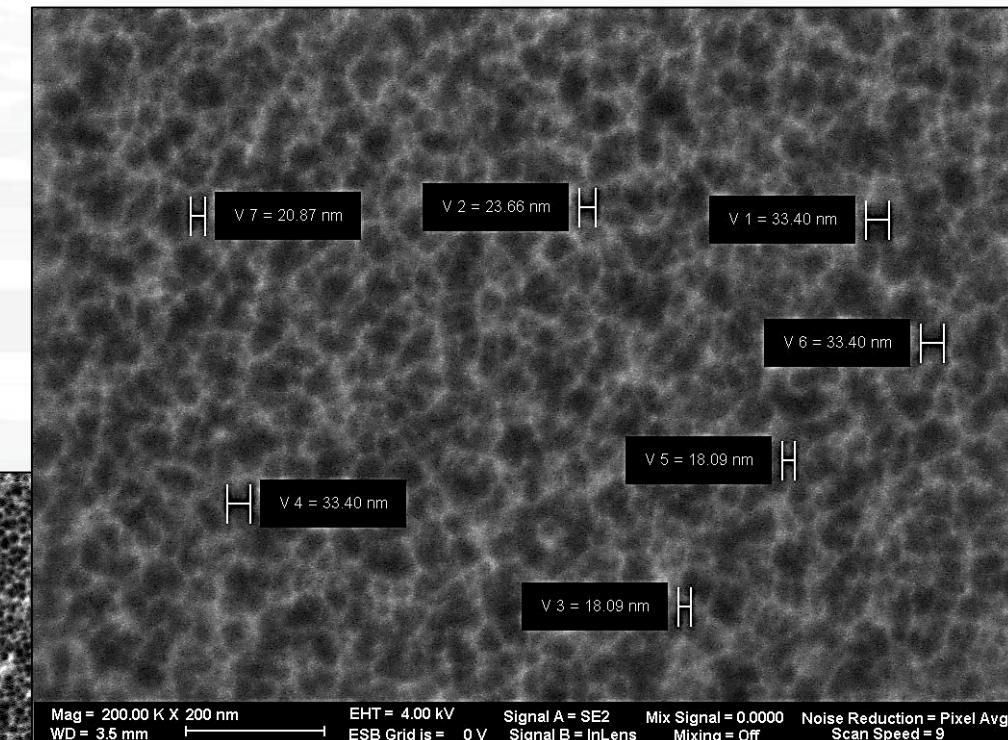
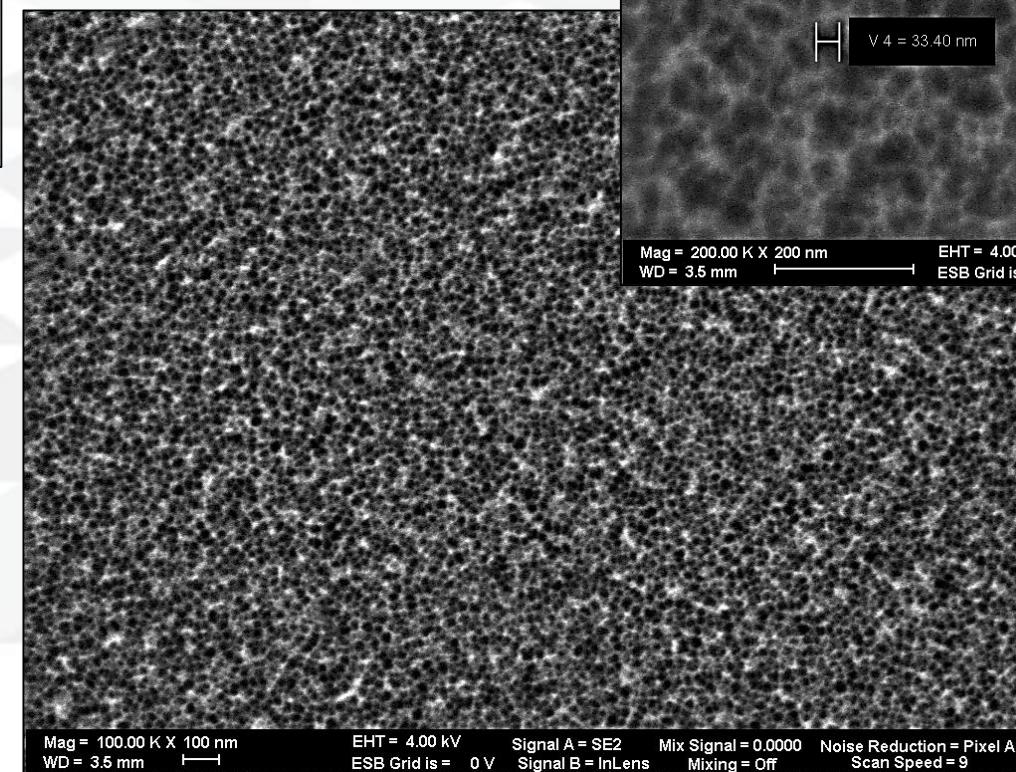
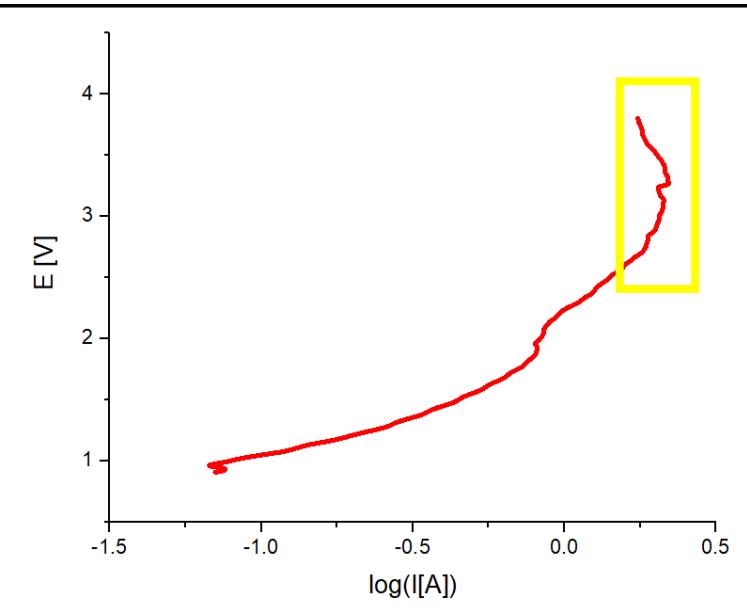
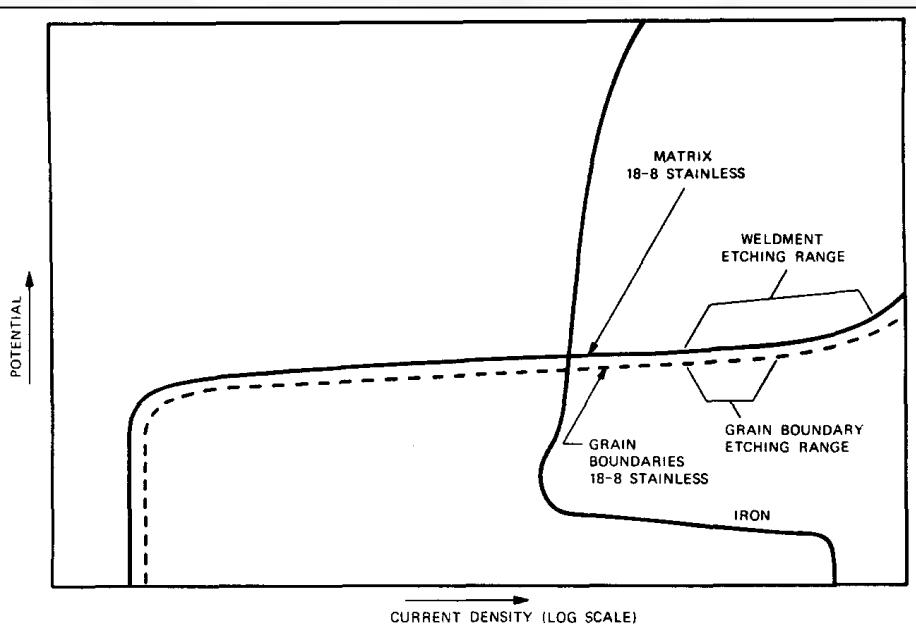
AMed (binder jetting) Si-SiC (CMC) drilling



Electro-discharge treatment

Research & Development – Advanced surface modification

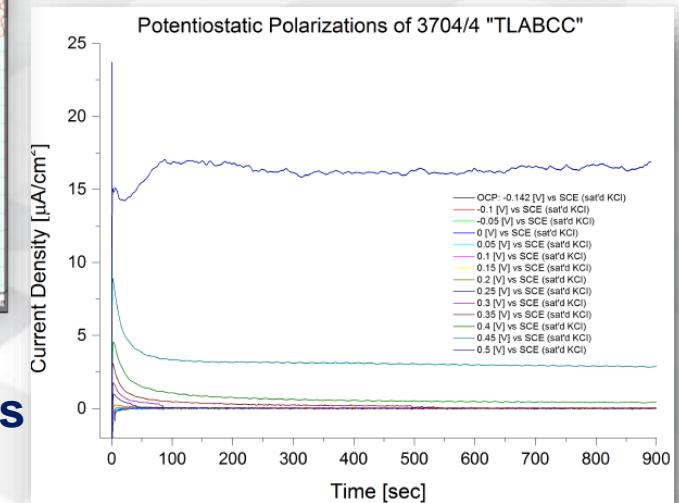
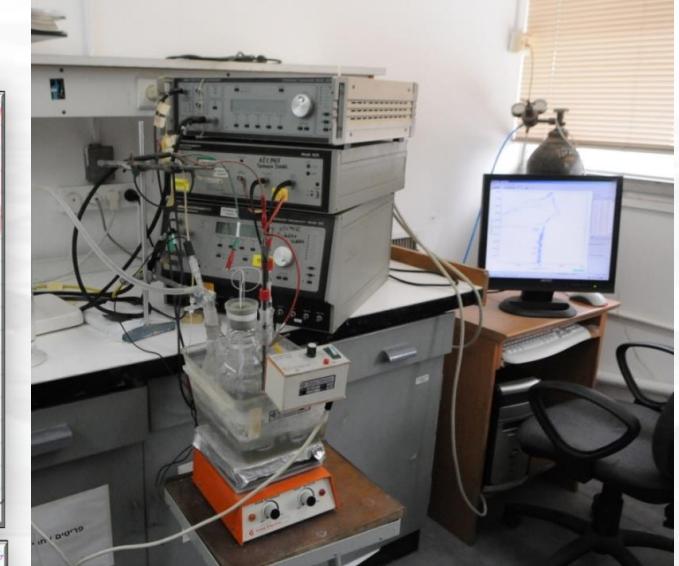
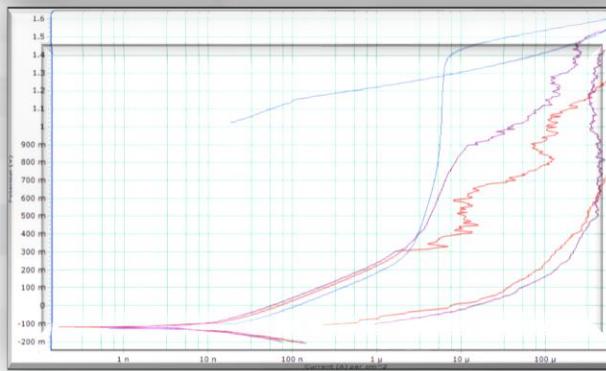
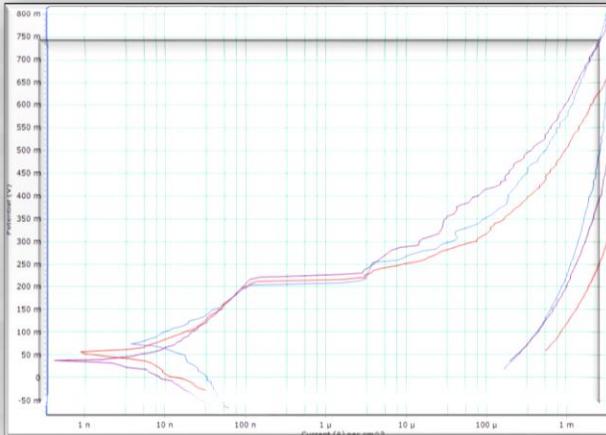
Potentiostatic nano etching of St.St. 316L (for improved osseointegration of medical implants)



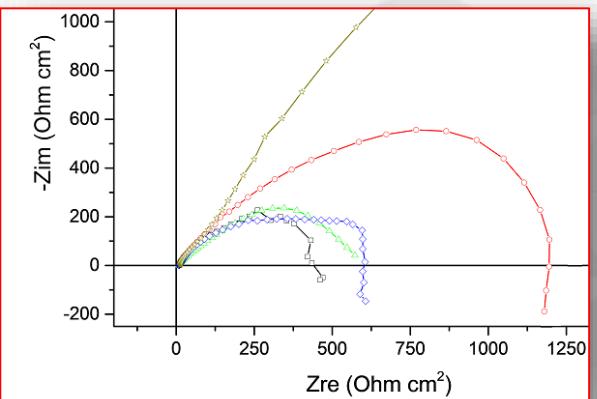
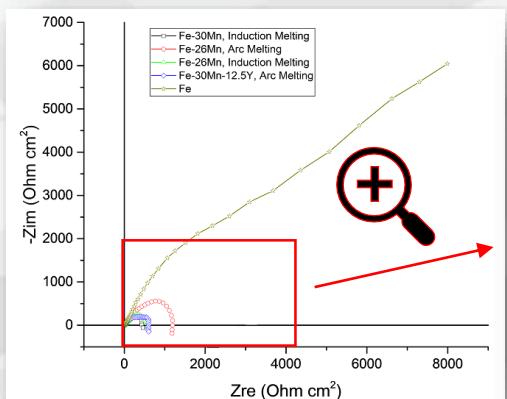
Testing & Characterization



ASTM B117:
Standard Practice for
Operating Salt Spray
(Fog) Apparatus



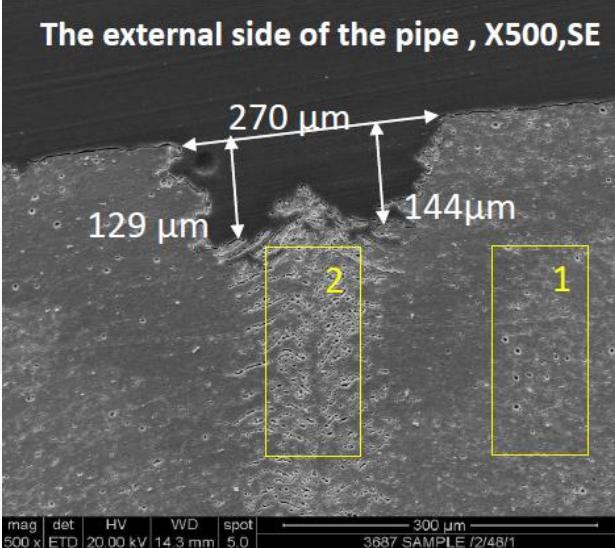
ASTM F-2129: cyclic polarization of nitinol stents



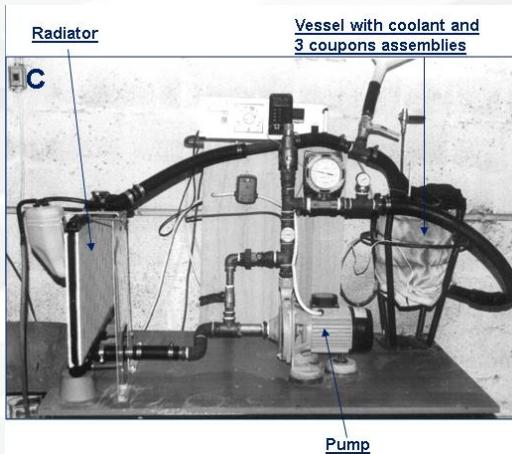
**Nyquist plot:
electrochemical
Impedance Spectroscopy
(EIS) of biodegradable
alloys for medical use**

ASTM F-746 Standard Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Materials (Co-Cr)

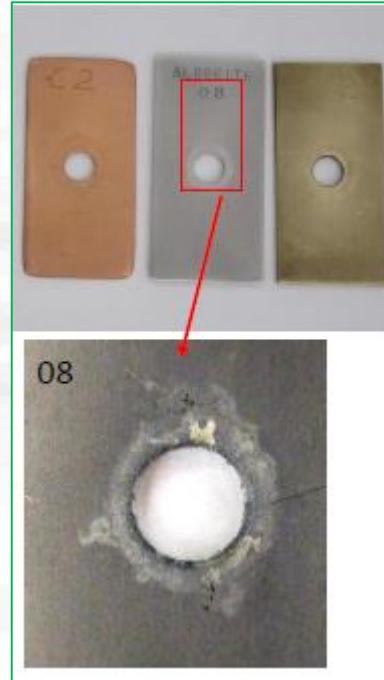
Testing & Characterization



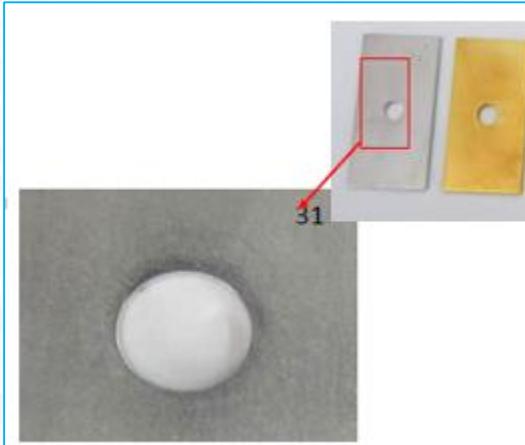
Welding evaluation: chemical resistance of Al5052 tubes in sulfamic acid solution



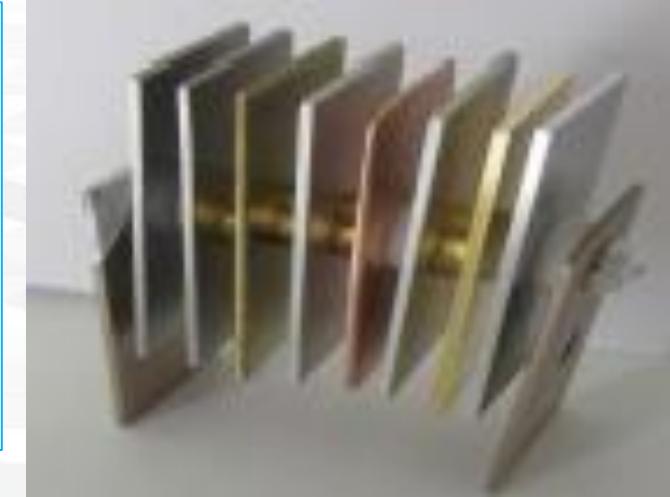
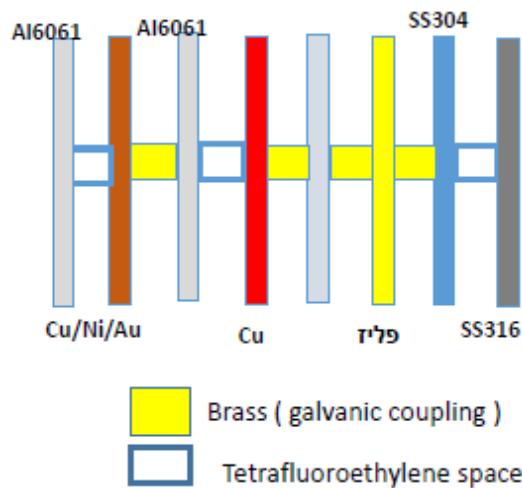
**Performance of inhibitors and coolant requirements according to ASTM 2570
“simulated service corrosion test”**



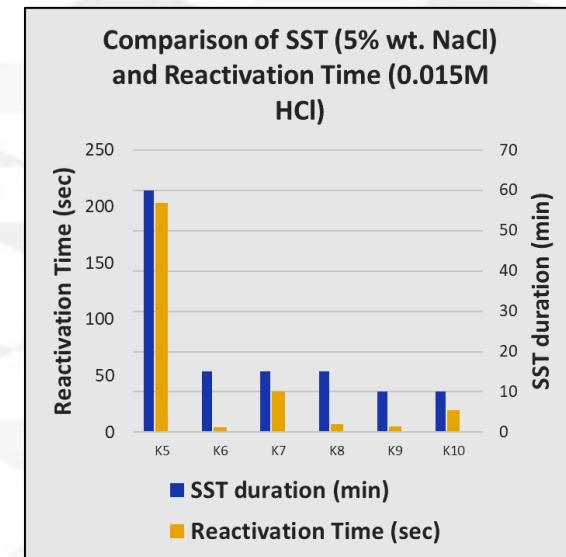
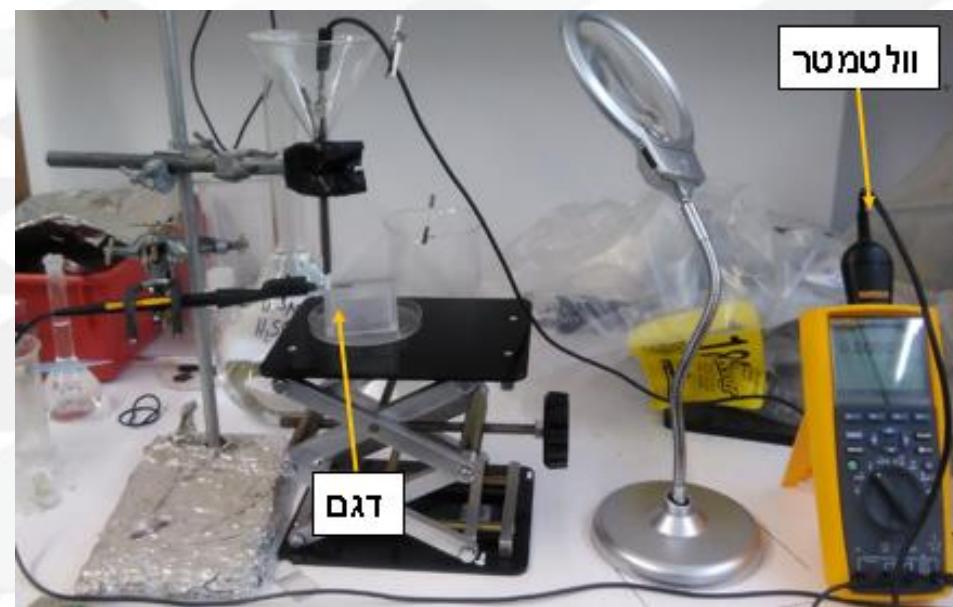
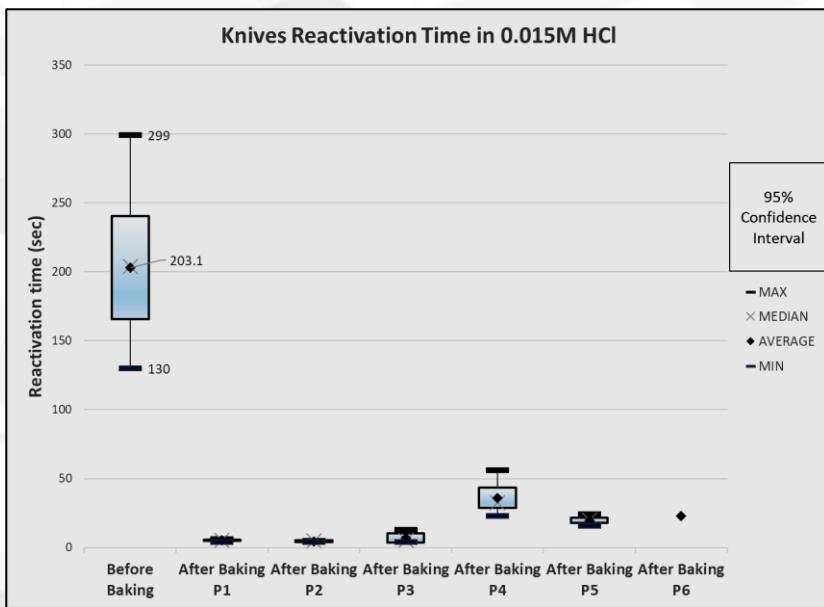
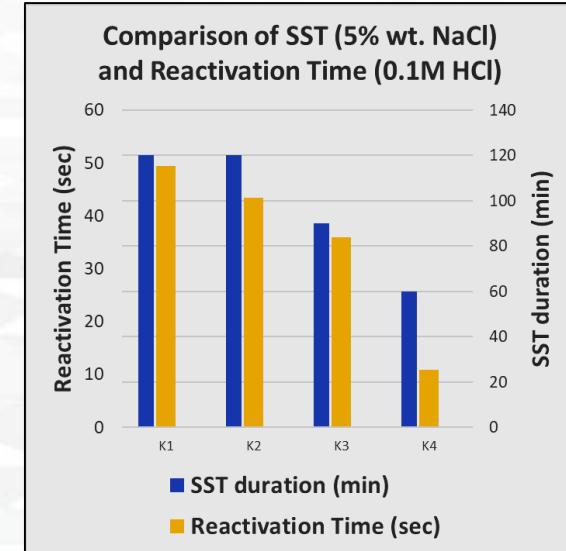
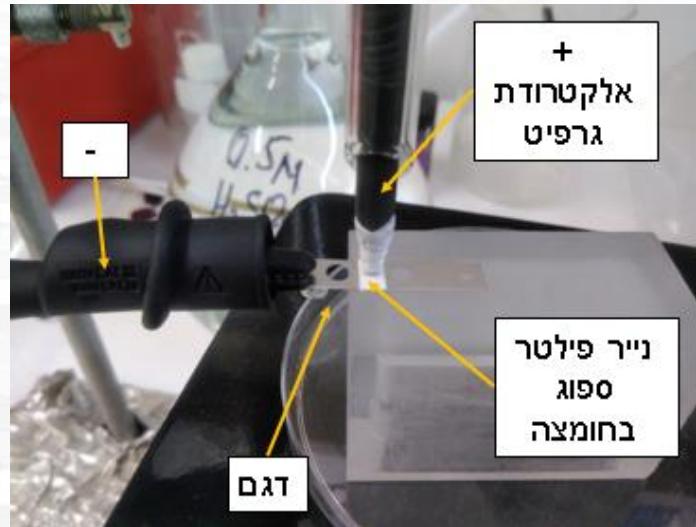
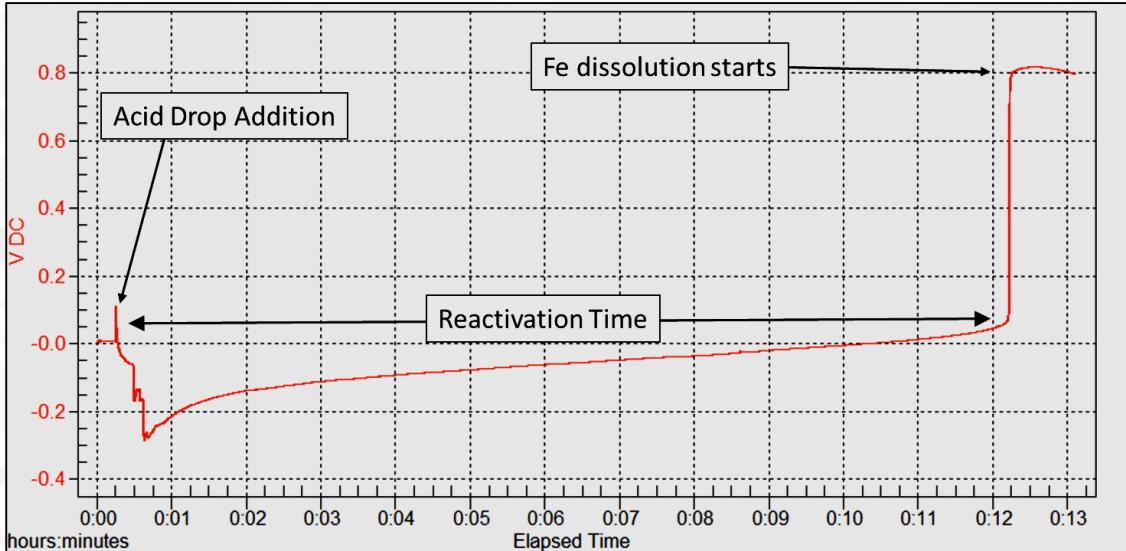
**Galvanic corrosion
Laboratory-scale simulation of laser cooling system (corrosion resistance)**



General corrosion

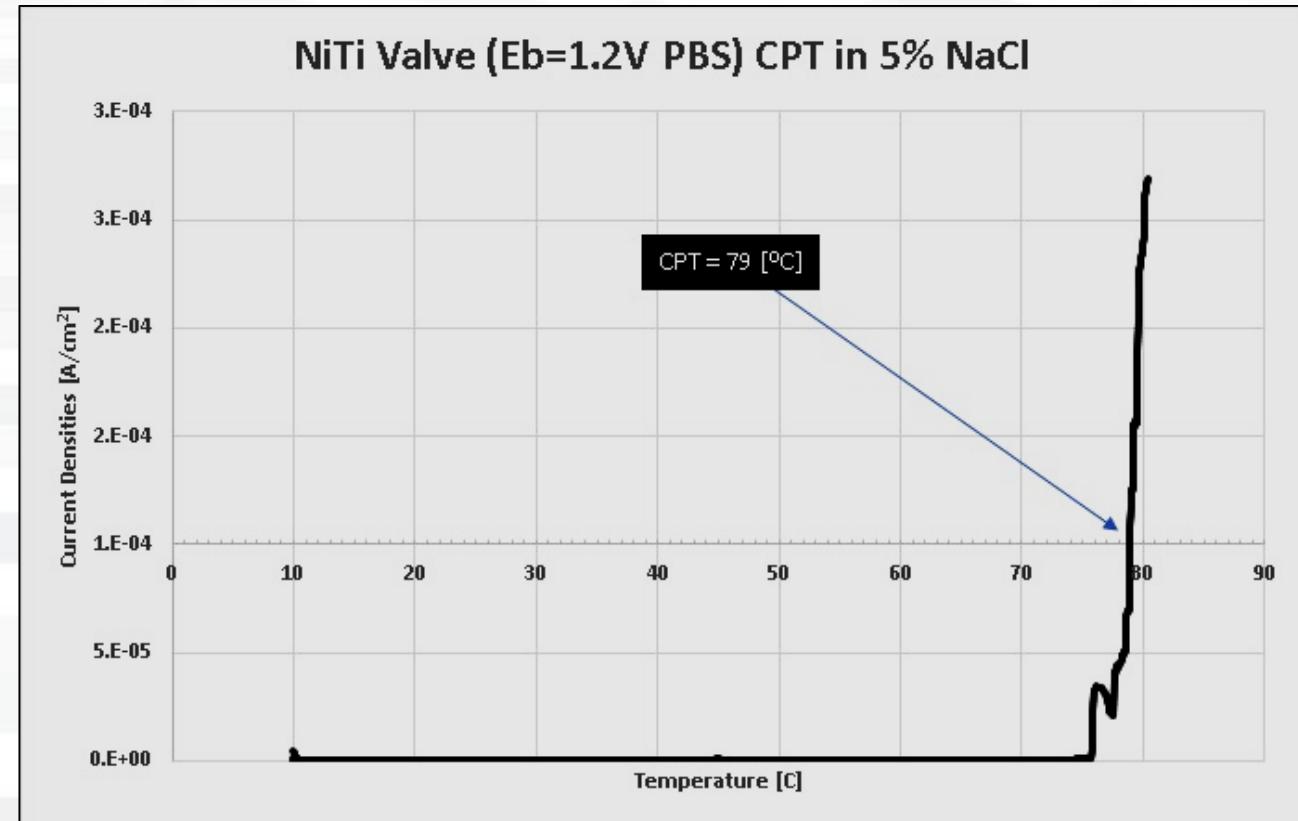
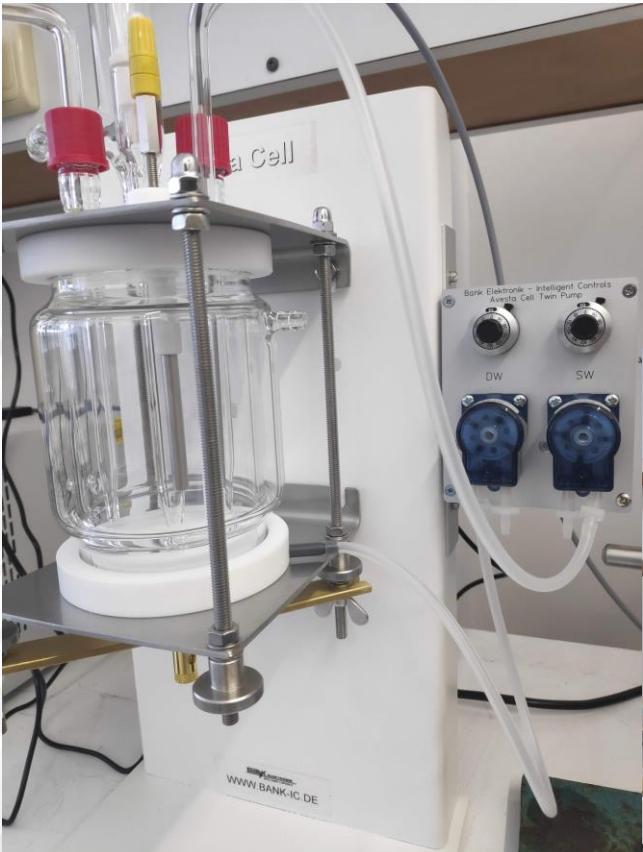


Testing & Characterization



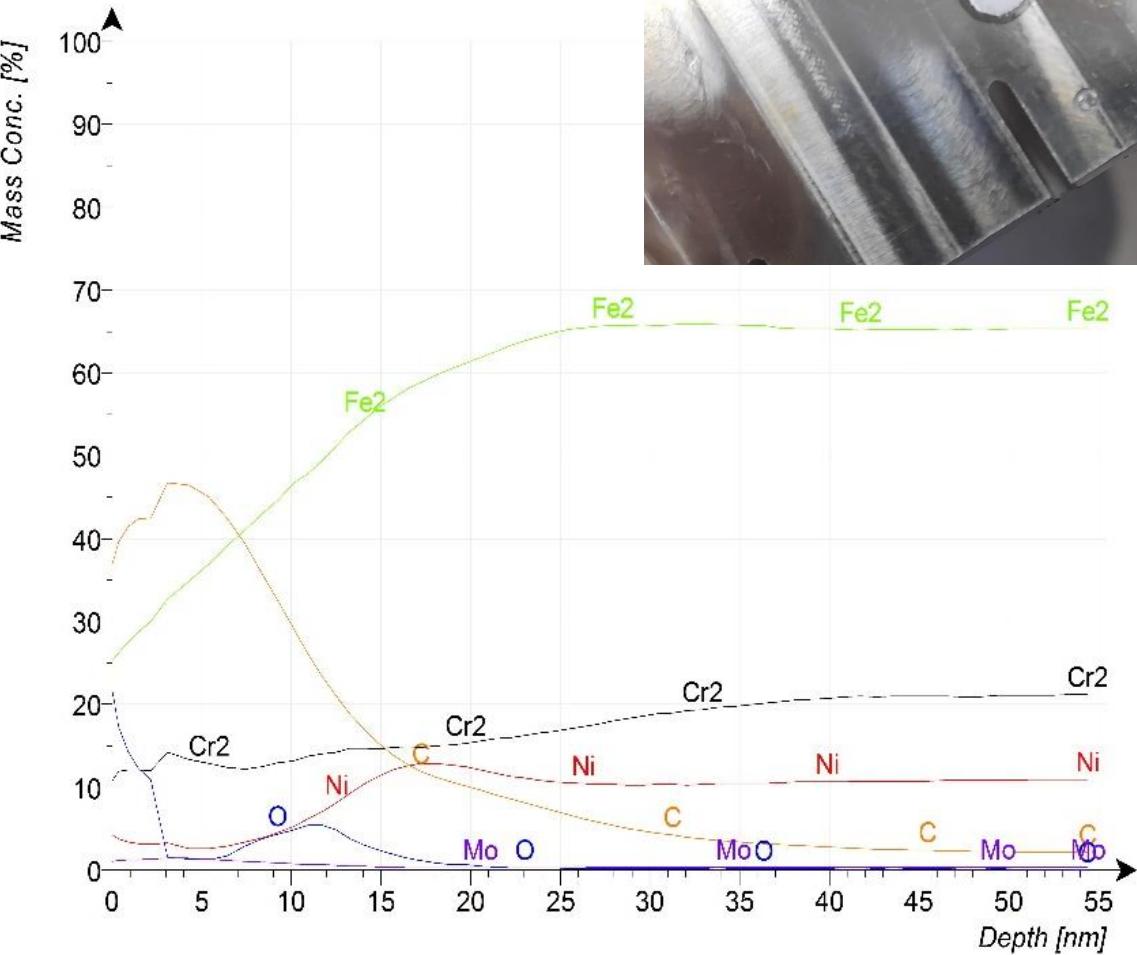
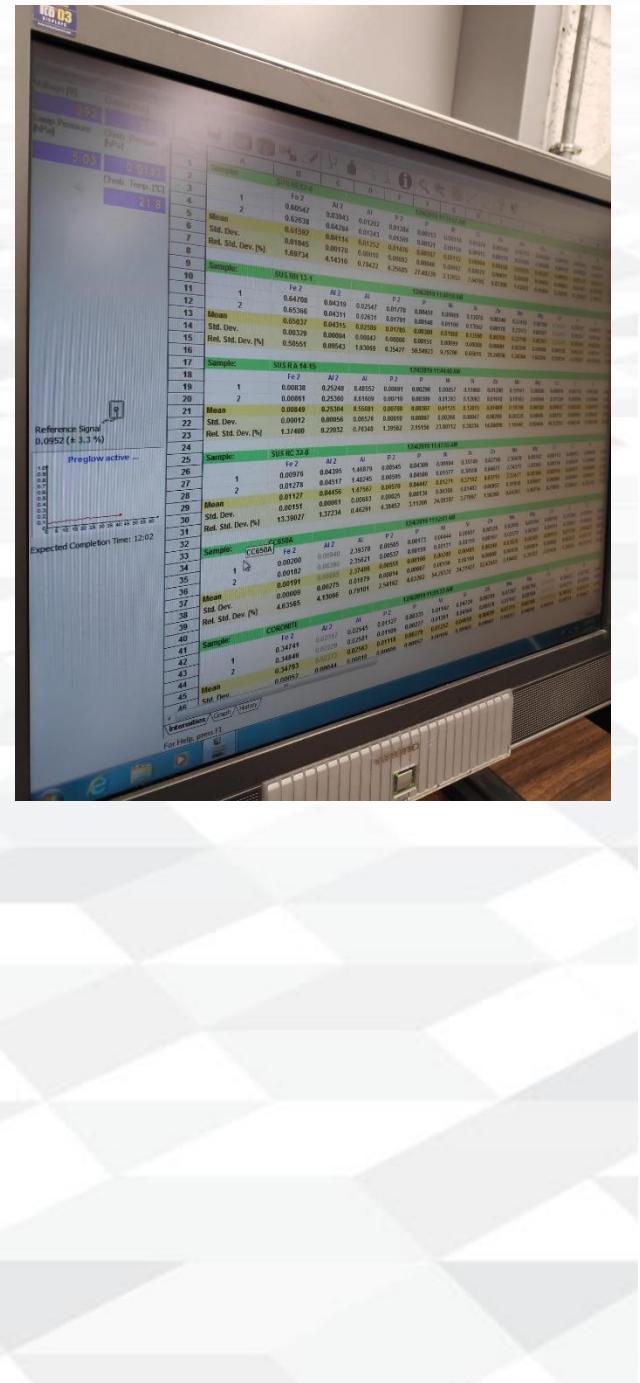
Stainless-steel “quick re-activation test” as substitution for salt spray test (SST)

Testing & Characterization



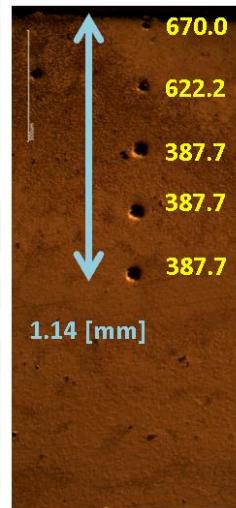
Critical pitting temperature (CPT) with smart heat liquid circulator
(linear or exponential temperature profile with external control)

Testing & Characterization

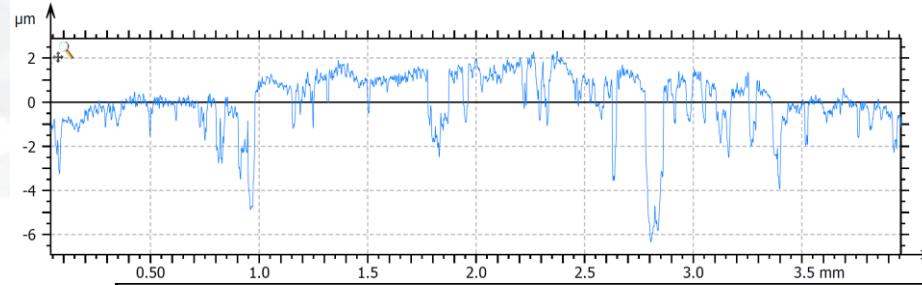


SPECTRUMA
GDA-750
Glow
Discharge
Optical
Emission
Spectroscopy

Other services (just some examples)



G21 Series



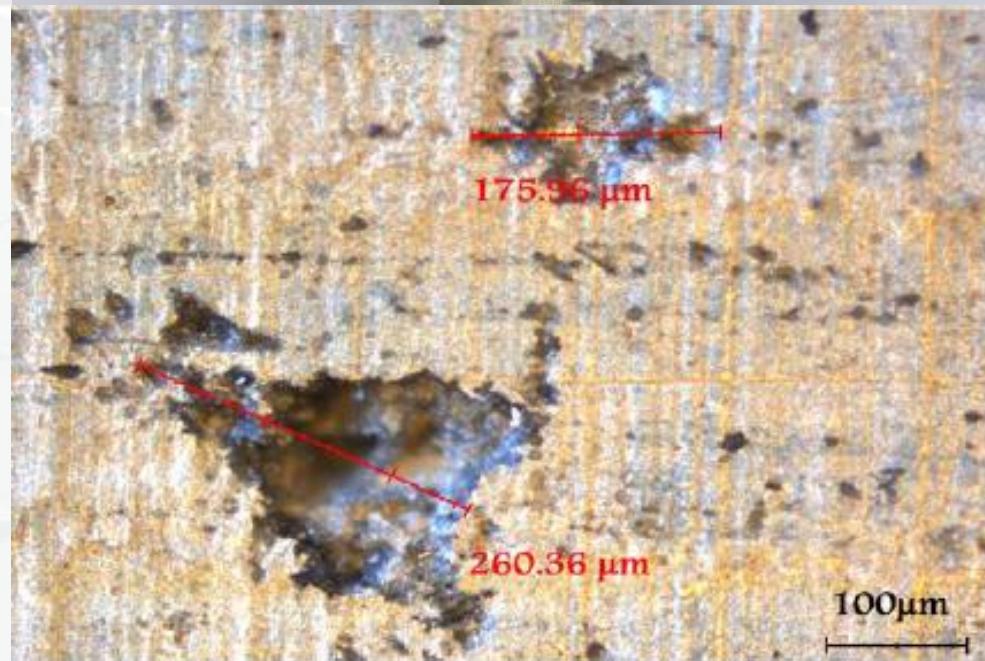
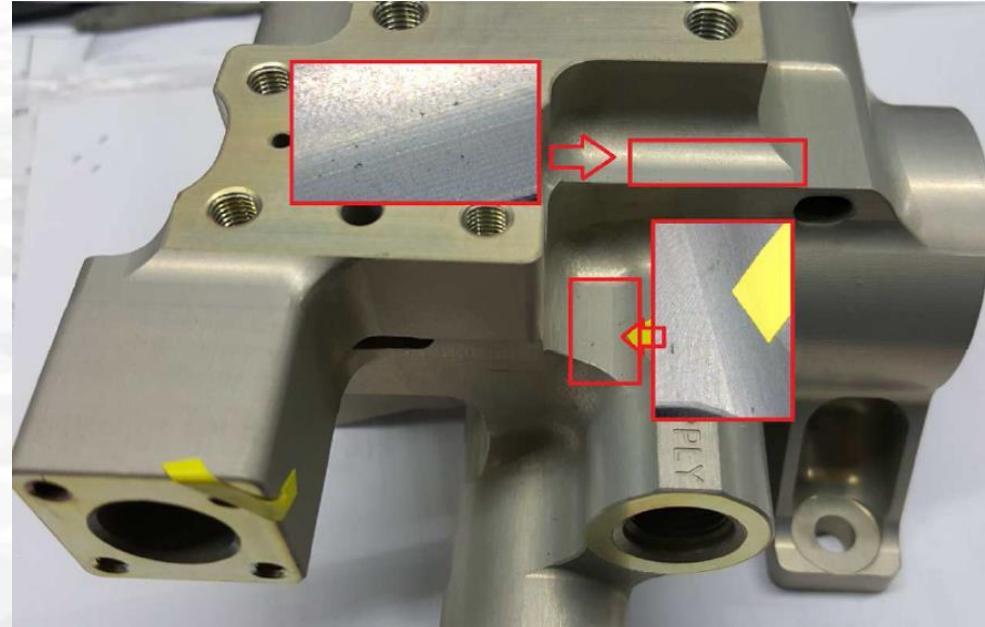
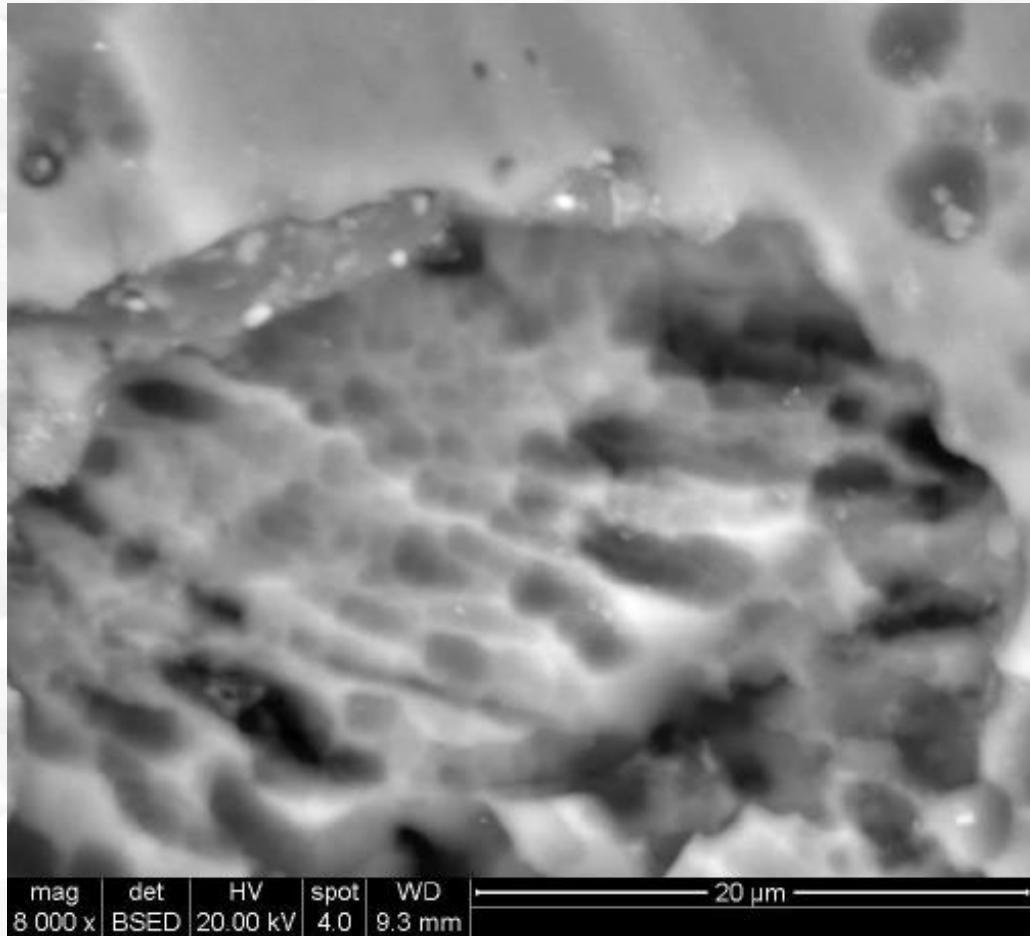
ISO 4287

Amplitude parameters - Roughness profile

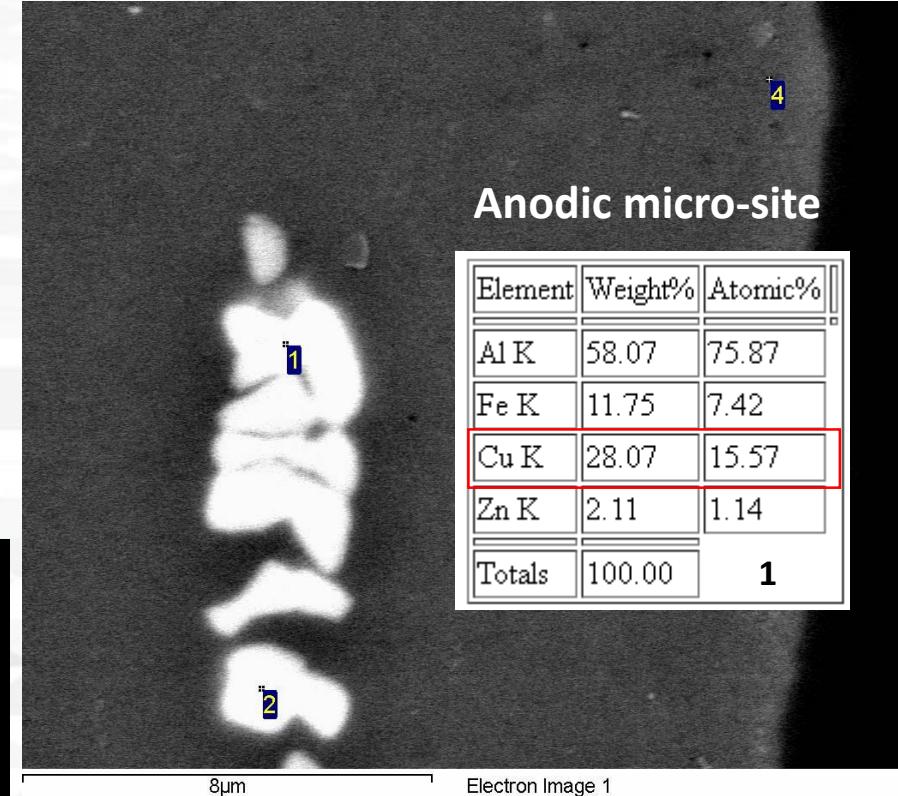
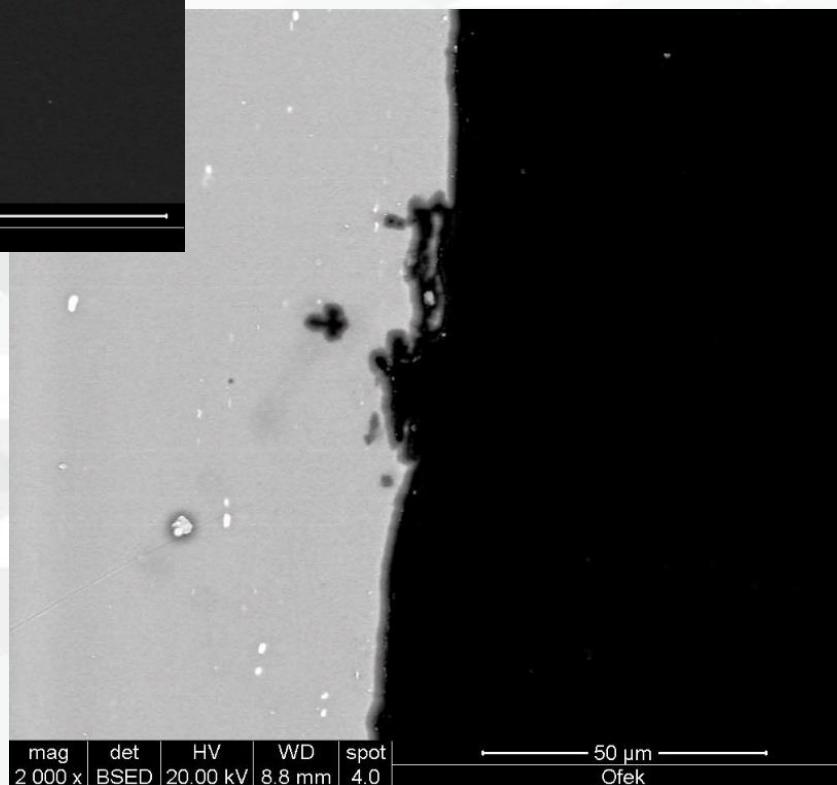
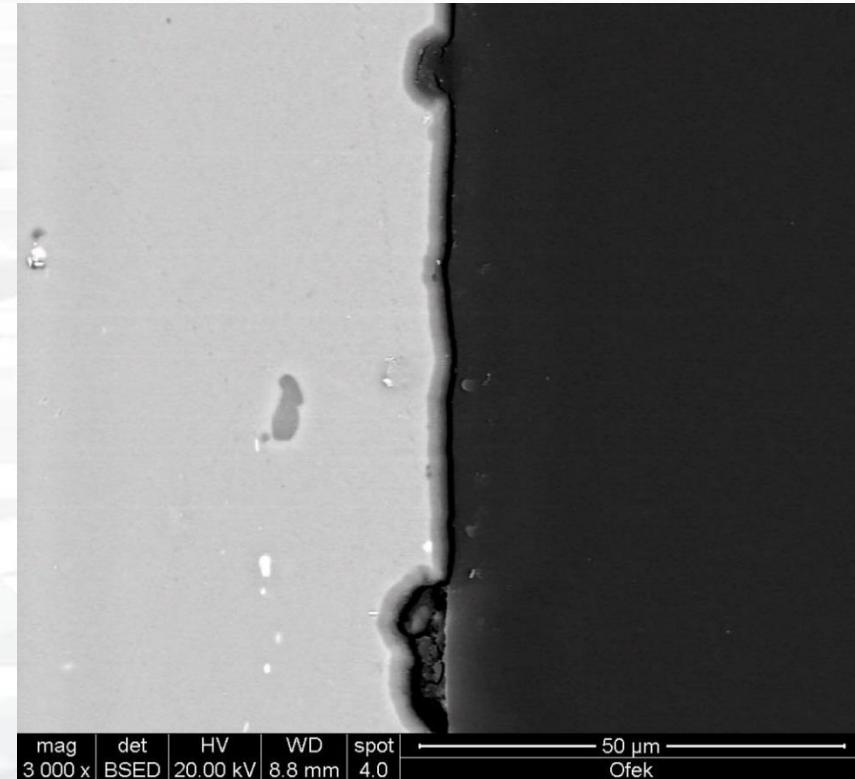
R _a	0.709	µm	Gaussian filter, 0.8 mm
R _q	0.993	µm	Gaussian filter, 0.8 mm
R _z	5.53	µm	Gaussian filter, 0.8 mm



Case study: failure analysis



Case study: failure analysis



CHEMICAL COMPOSITION LIMITS (WT %)

Si	0.12	Zn	5.7-6.7
Fe	0.15	Zr.....	0.08-0.115
Cu.....	2.0-2.6	Tl.....	0.06
Mn	0.10	Others, each ..	0.5
Mg	1.9-2.6	Others, total ..	0.15
Cr	0.04	Balance	Aluminum

Note: Value maximum if range not shown.

Alcoa 7050 Data Sheet

On-site services



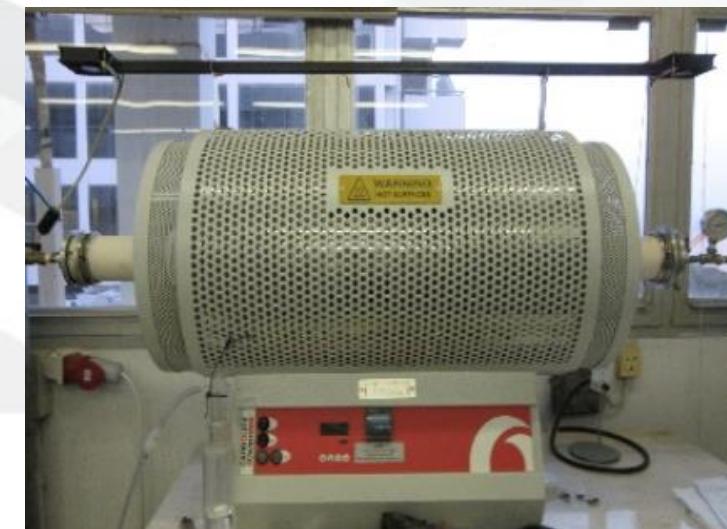
Different Topics



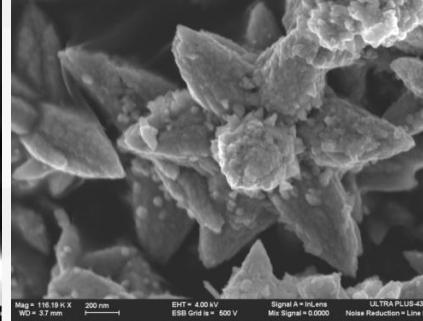
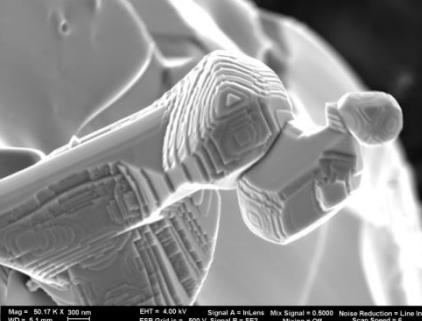
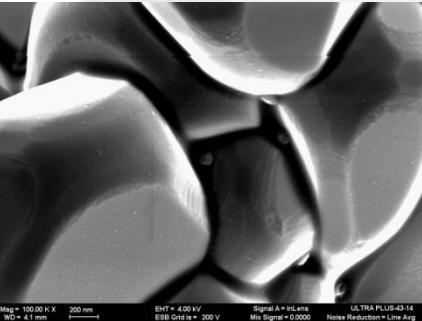
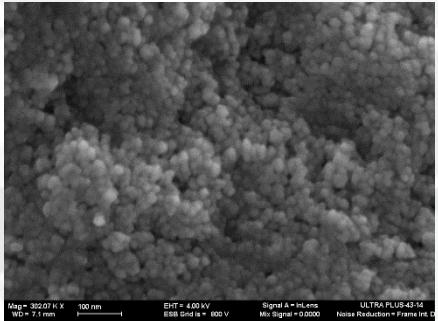
by CyberLink
PowerDirector



Development of 3D printed magnets



Synthesis of magnetic materials



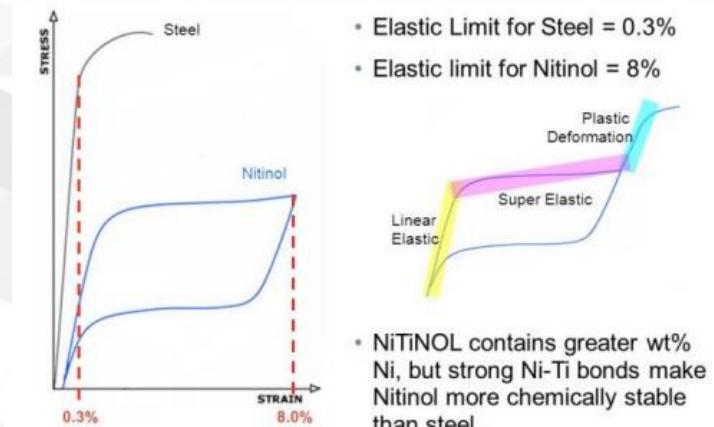
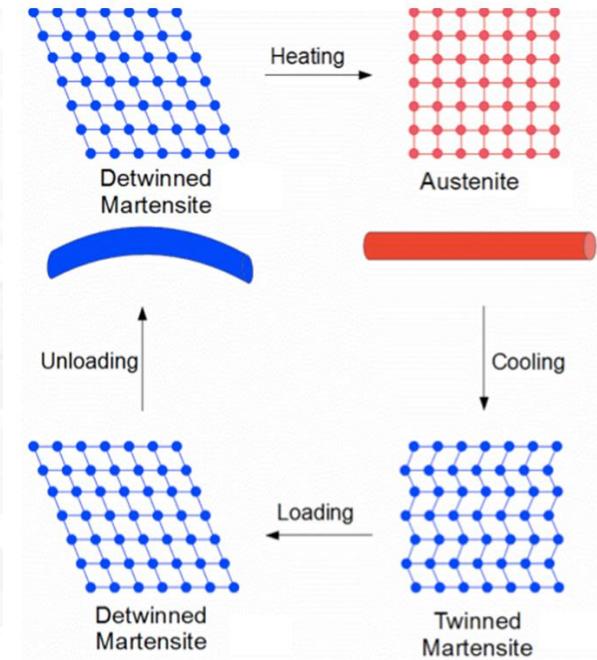
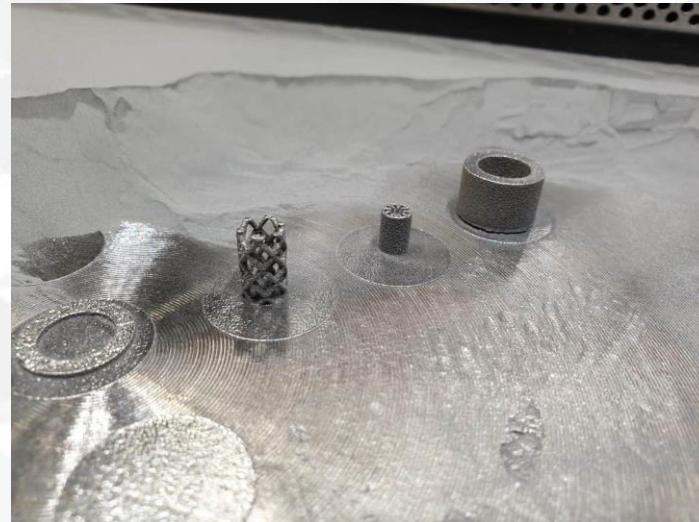
Mag = 50.17 K X 200 nm EHT = 4.00 kV Signal A = Intens. ESB Grid is = 500 V Mix Signal = 0.0000 Noise Reduction = Line Int. Scale Speed = 4.0 WD = 5.1 mm

Mag = 116.19 K X 200 nm EHT = 4.00 kV Signal A = Intens. ESB Grid is = 500 V Signal B = 5E3 Mix Signal = 0.0000 Noise Reduction = Line Int. Scale Speed = 4.0 WD = 3.7 mm

Different Topics



NiTi4 Powder 15-45 µm
Raw material supplied to TLS by Memry
Bulk complies with ASTM F2063:
Standard Specification for Wrought Nickel-Titanium Shape Memory Alloys for Medical Devices and Surgical Implants

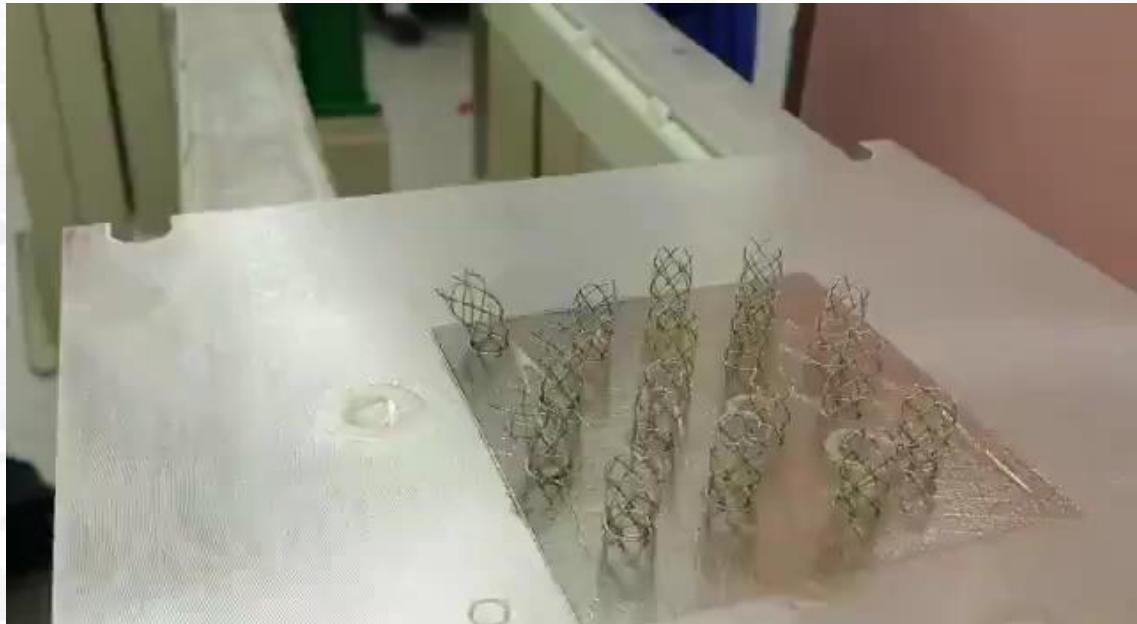


- Elastic Limit for Steel = 0.3%
- Elastic limit for Nitinol = 8%

NiTINOL contains greater wt% Ni, but strong Ni-Ti bonds make Nitinol more chemically stable than steel.

Development of 3D printed nitinol (SMA/super-elastic)

Different Topics



Element	Weight%	Atomic%
Ti K	44.24	49.30
Ni K	55.76	50.70
Totals	100.00	

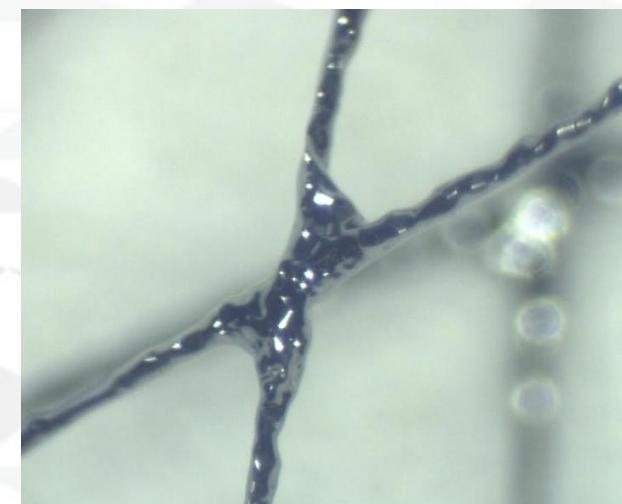
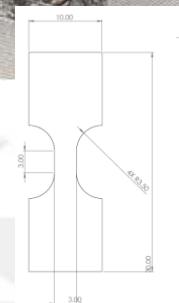
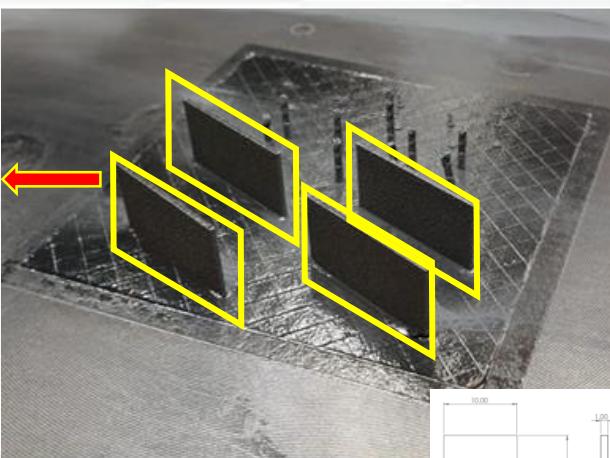
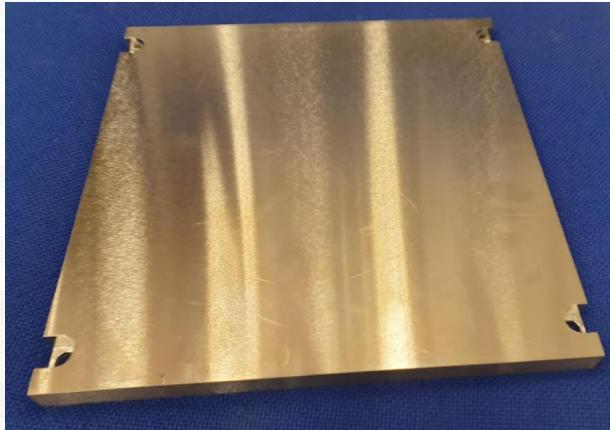
EDS of printed parts

TABLE 1 Chemical Composition Requirements

Element	% (mass/mass)
Nickel	54.5 to 57.0
Carbon, maximum	0.050
Cobalt, maximum	0.050
Copper, maximum	0.010
Chromium, maximum	0.010
Hydrogen, maximum	0.005
Iron, maximum	0.050
Niobium, maximum	0.025
Nitrogen plus Oxygen, maximum	0.050
Titanium ^a	Balance

^a Approximately equal to the difference between 100 % and the sum percentage of the other specified elements. The percentage titanium content by difference is not required to be reported.

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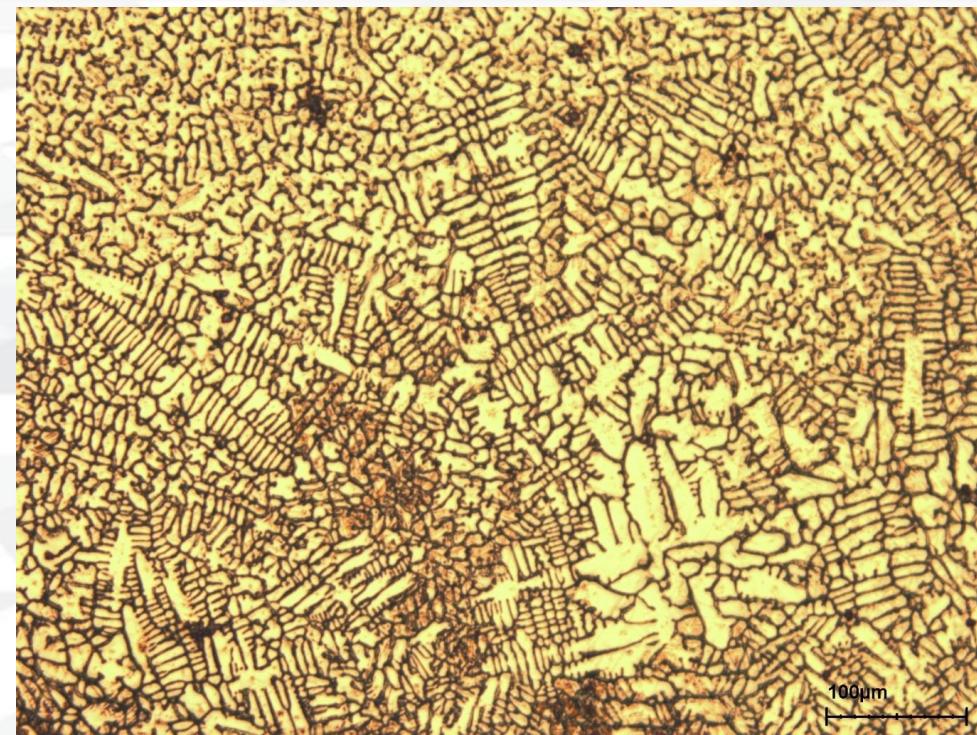
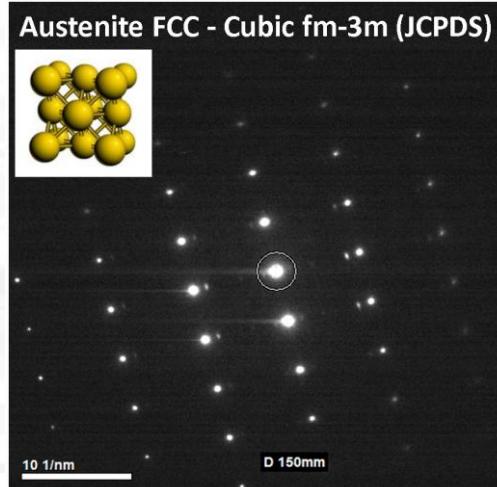
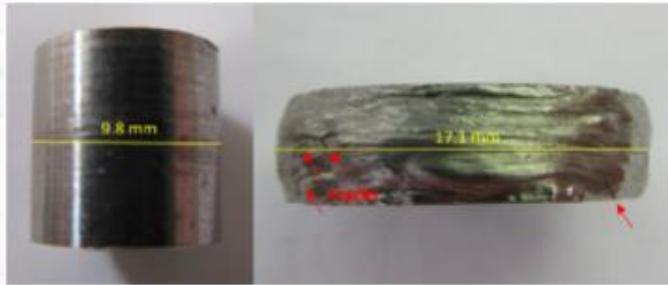
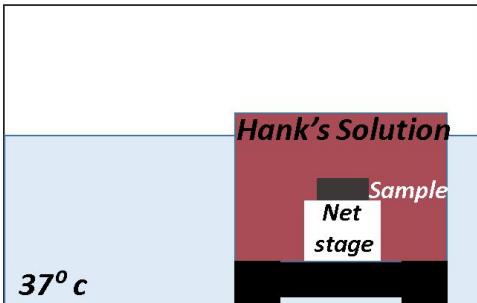


Development of 3D printed nitinol (SMA/super-elastic)

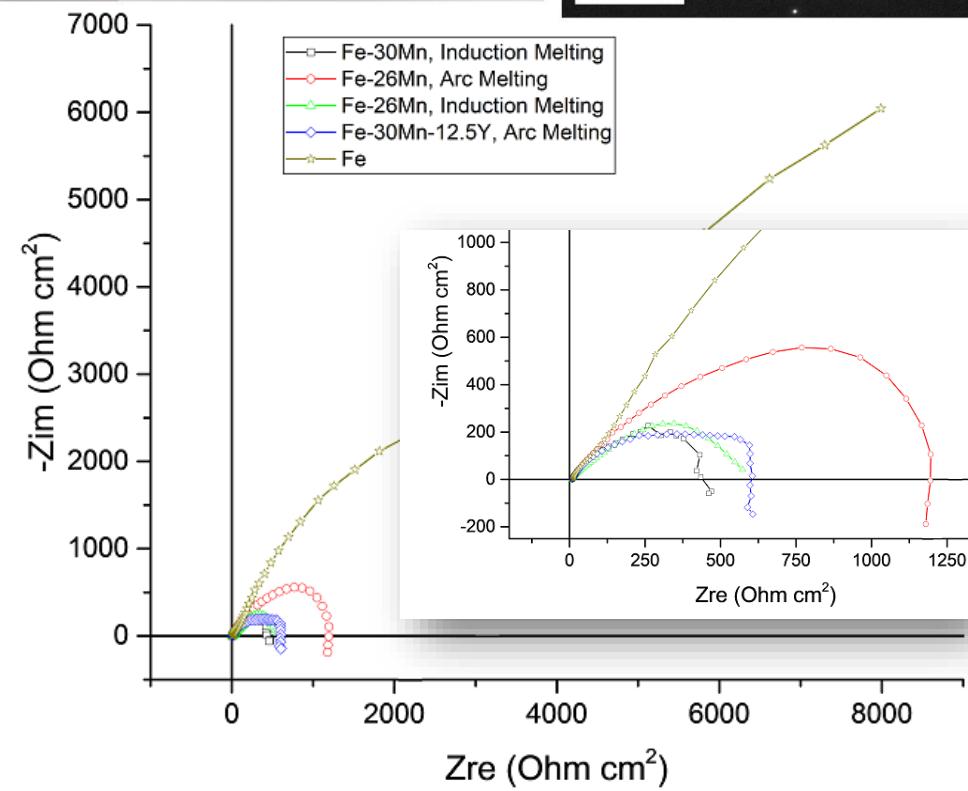
Different Topics



Setup

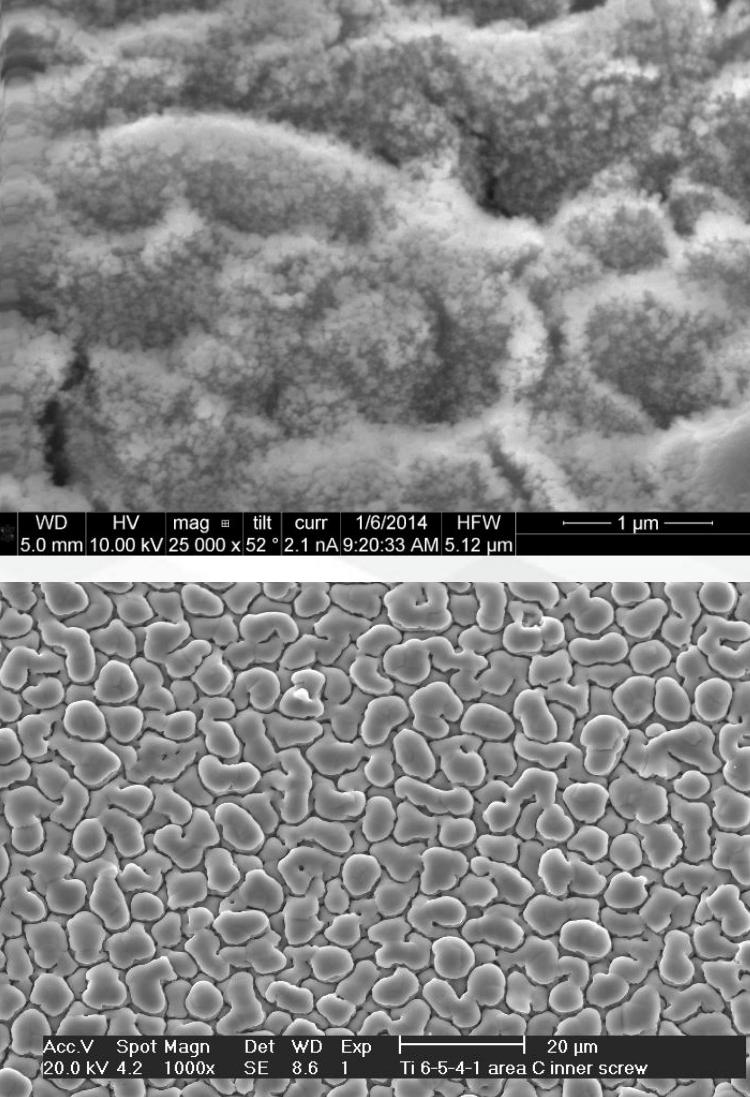
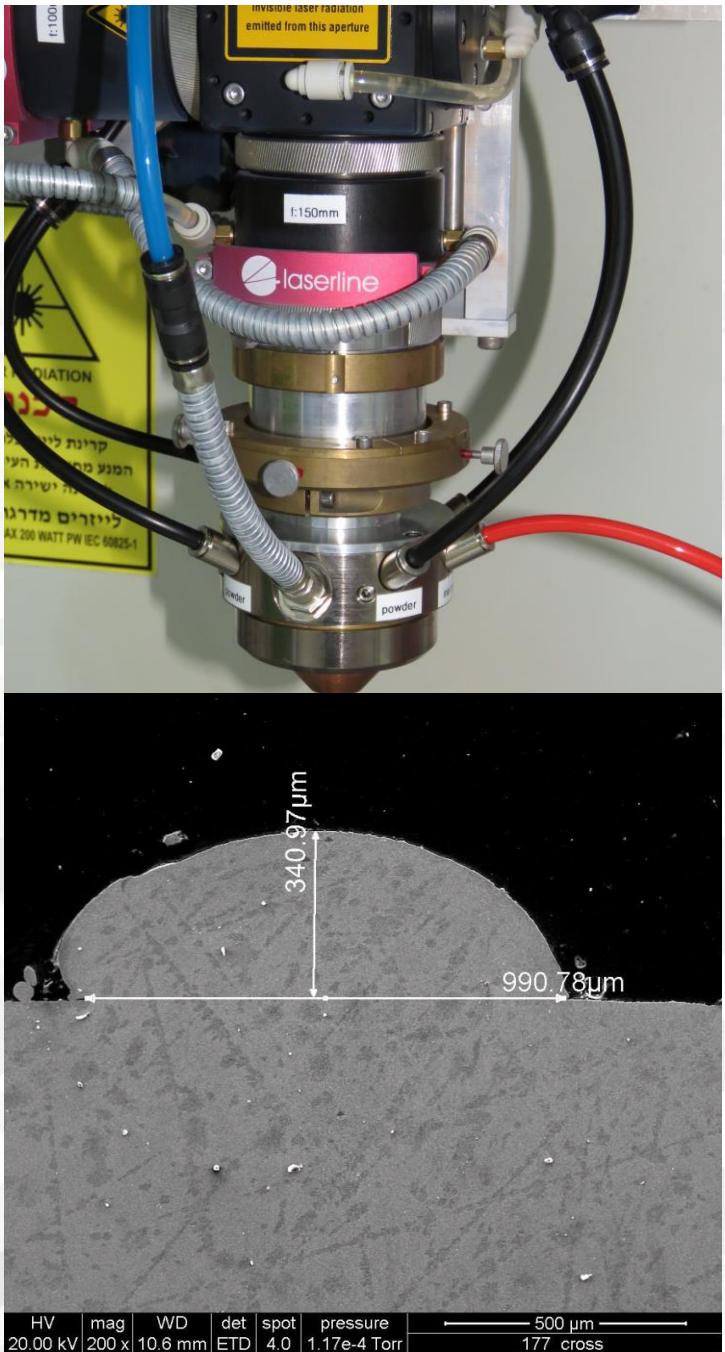


$$CR = \frac{K \times \Delta W}{A \times t \times \rho}$$

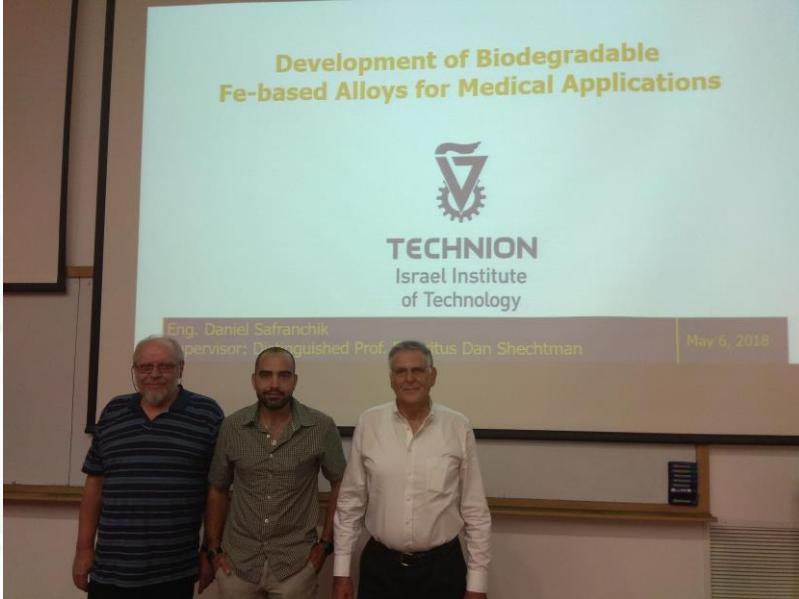


Development of biodegradable metallic implants

Different Topics



Laser technologies



Some of our on-going projects:

Project	Partners
Jet PEP – localized plasma electro-polishing	TU Chemnitz, Leukhardt, BTE
Nitinol 3D	Kanfit 3D
St. St. 3D	Ham-Let
Surface technologies for Ti-64	Limat, Afeka
Aluminum 3D	Prof. Osovski, Elbit
New concept for landing gear	Elbit
Development of magnetic materials	IAI
Development of diamond based composite coatings	Glik
Replacement of CRM	COST action “CRM-Extreme”
Certification of adhesion bonding technologies	COST action “Certbond”

National funding opportunities

תיאור המסלול	תיאור	מימון	תקופת מחקר	מועד הгазה	קניין ותמלוגים	הערות
הכוונת ידע: נפר קמין	ביצוע מחקר מדעי לאור צרכי התעשייה	10-90 0-85	עד שנתיים (газה שנתית)	3-2 פעמים בשנה	ברשות הטכניון, זכויות ראשונים למפעל	טכניון אקדמיה
מכינת המו"פ	בדיקת התאמה לתיעוש	75% מימון עד 100,000 ₪ לאזרור פיתוח א, מתוכם 40,000 ₪ ישולם למכון Ciיעוז	מסלול לתקופות קצרות עד 9 חודשים	חופשי	לא תמלוגים	הליך אישור מוצר, טוב לסקר שוק, בדיקת יתכנותות וכו'
העברת ידע: מגנטון	תיעוש ידע מהאקדמיה	% 66 מימון לכלל התקציב ע"י הרשות, התשלום למכון המחקר ע"י התעשייה ולאחר השלמה - 100% תקירה 3.4 מ' ₪ לשנתיים	עד שנתיים (газה שנתית)	3-2 פעמים בשנה	הסכם תיעוש מראש ייחתום בין הטכניון ובין המפעל, ללא תמלוגים לרשות החדשנות	אין הכרה בצד ייעודי (להבדיל ממאגד מגנ"ט)
מו"פ תעשייתי, לשעבר קרן החו"פ	פיתוח טכנולוגיות בתעשייה	% 50-30 מימון + 10% שותפות מכון ב- 20% לפחות + 10% אזרוי פיתוח ללא תקירה, לרוב מאושר סכום סביר 1.2 מ' ₪ לשנה	עד שלוש שנים (ממוצע) לשנתיים	חופשי	הידע שייר ל重要指示, תמלוגים מול הרשות עד סכום ההשקעה במידה ההצלחה (מהגידול היחסיב במכירות), * פטור ל重要指示 מסורתית עם הכנסות עד 70 מ' דולר בשנה הקודמת להガשה (לרוב עד 3 הgasות ב-5 השנים האחרונות)	tabniot ייצור עד תקירה של 500,000 ₪ רכישת ידע מחו"ל עד תקירה של 250,000 ₪ הוצאות פיתוח מכונות ייצור רכיבים לבניית מכונה ייצור (אב טיפוס) עד תקירה של 500,000 ₪ הדרכות לעובדים עד תקירה של 25,000 ₪ שיווק עד תקירה של 15% מתקציב התקין

The team



Daniel Safranchik
Head of the lab



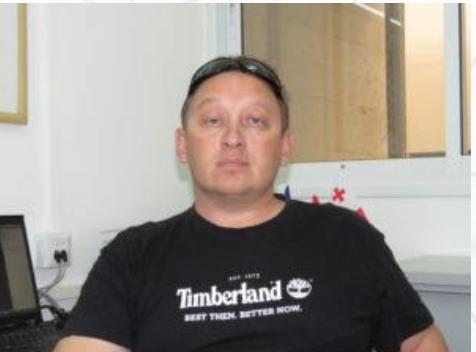
Alla Pismenny
Research engineer



Mila Levin
Research engineer



Gennady Kozyukin
Deputy head of the lab



Victor Lumelsky
Research engineer



Dr. Sergey Elfimchev
Research engineer

Research assistants:
Ohad Zand
Idan Lerner
Yair Reichman



Israel Institute of Metals

"The best way to predict the future is to create it"

Peter Drucker

Daniel Safranchik

Head of Corrosion & Surface Technologies Laboratory

T. +972-4-829-4494 | M. +972-52-8851210 | F. +972-4-823-5103

E-mail: DaniS@trdf.technion.ac.il | Web: iim.technion.ac.il

Technion City, Haifa 3200003, Israel

