



TECHNION R&D
Foundation Ltd.

Israel Institute of Metals

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

Short-term activities

Applied research for the industry

Advisory for the industry

National and multilateral funded R&D projects

Testing according to standards

Commercialization and industrialization

Failure analysis

Supervision of undergraduate and graduate students

On-site inspection services

Dissemination and exploitation

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

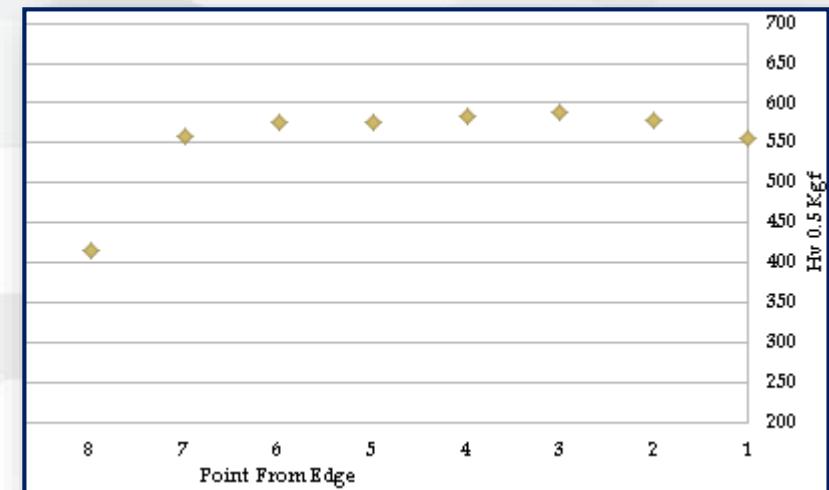
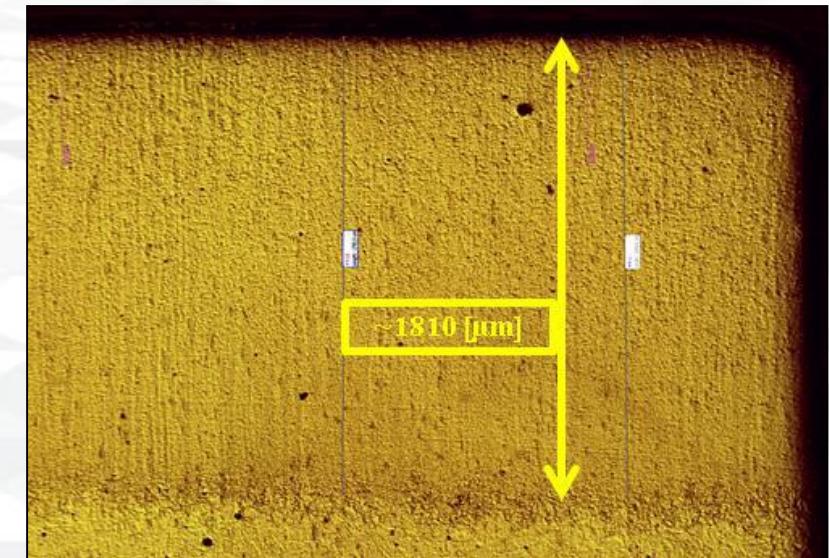
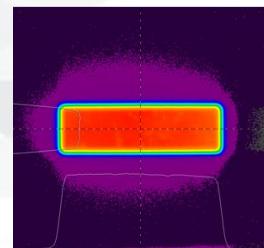
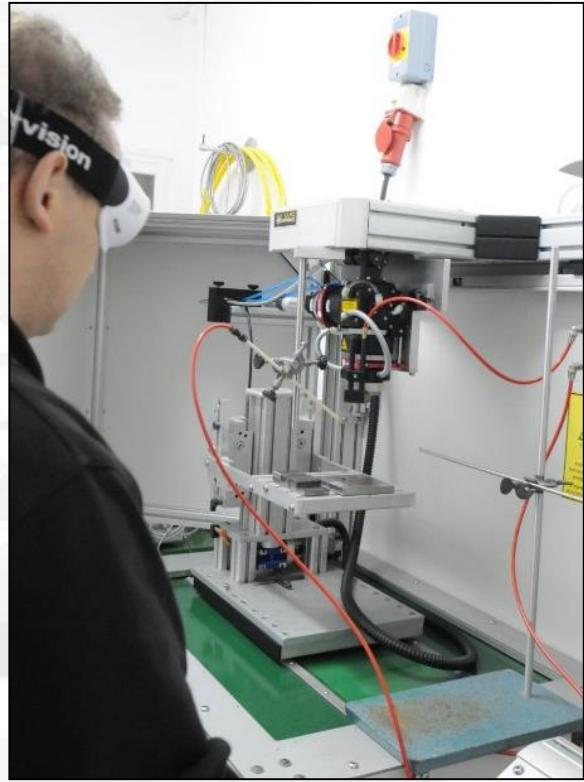


Image of water drop on Al6061 surface before coating



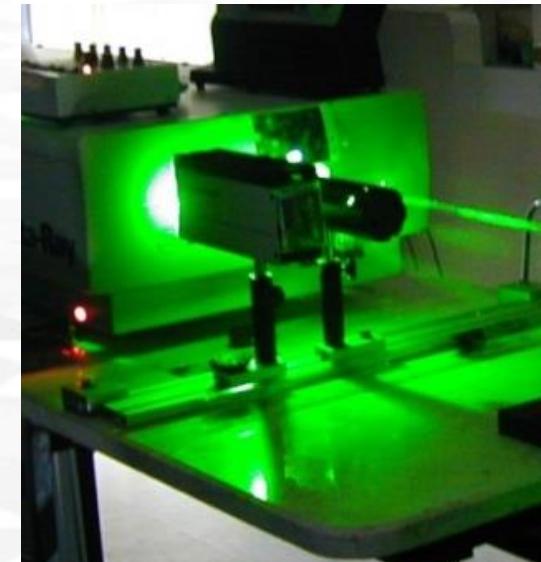
Case study

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:

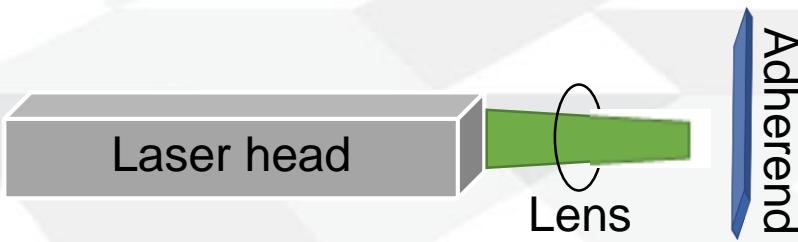
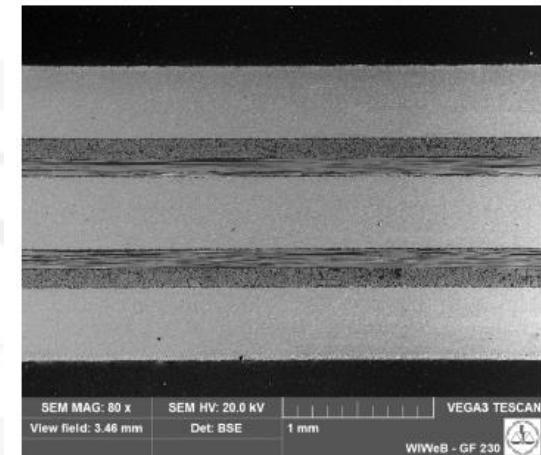
Surface treatment to achieve strong and durable bonds, based on

Cleaning

Chemical activation

Morphological changes (texturizing/roughening)

Surface Ablation



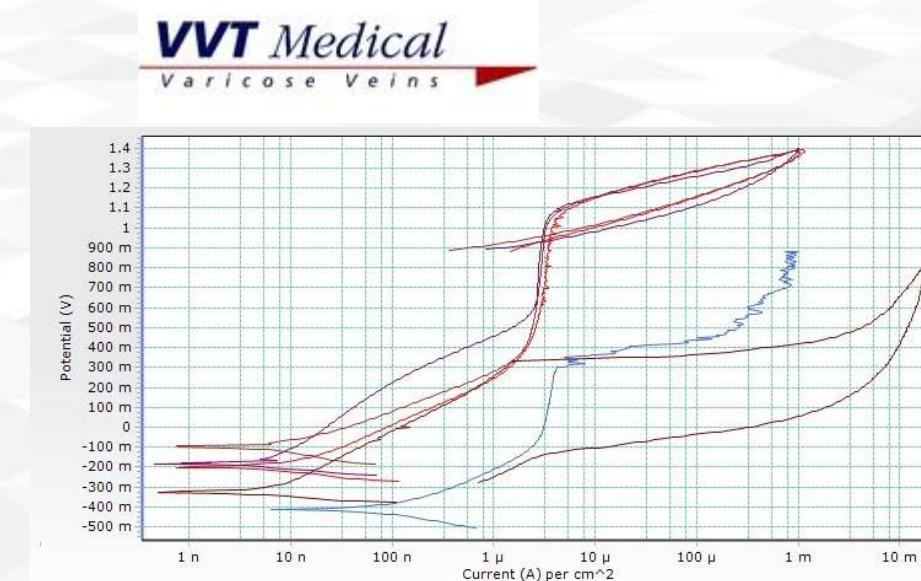
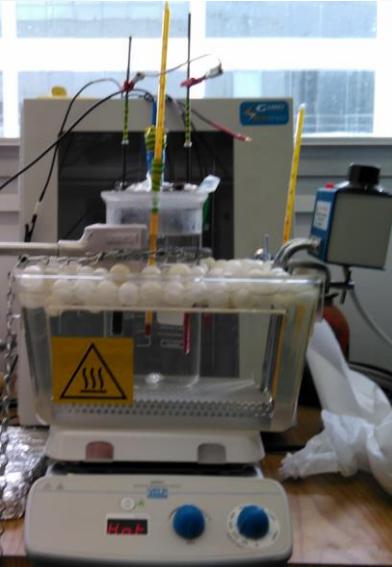
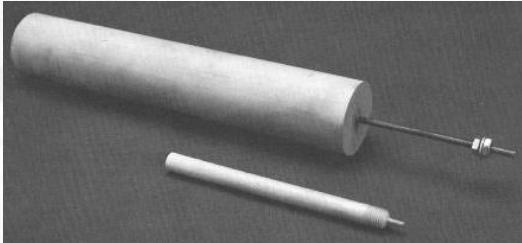
Environmental Friendly



Case study

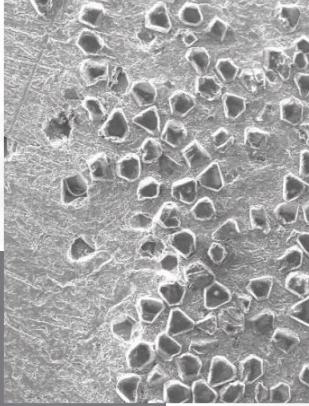
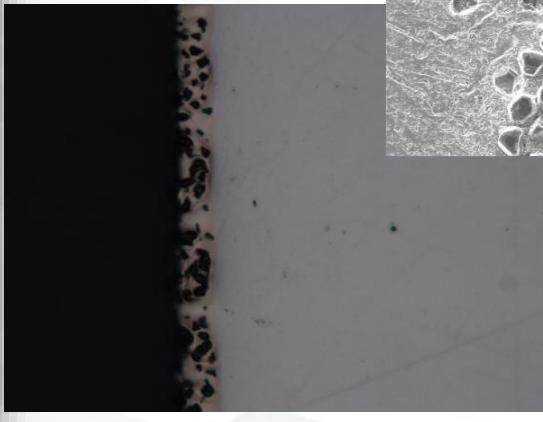
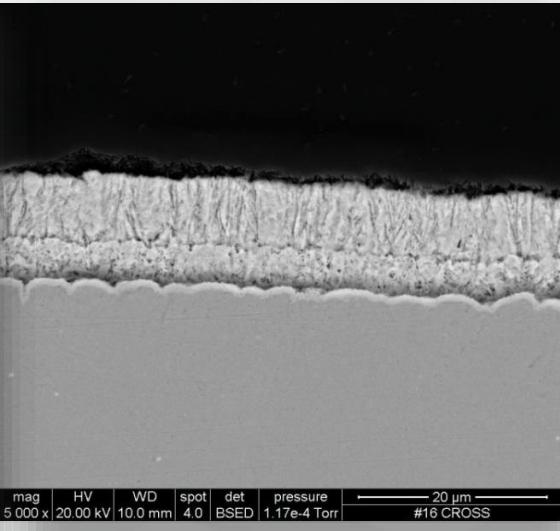
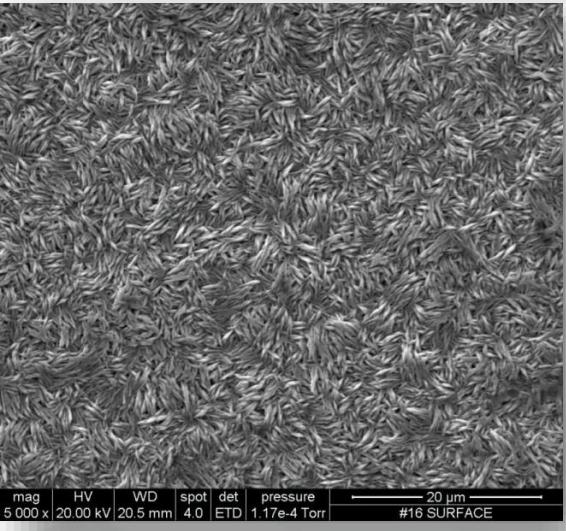
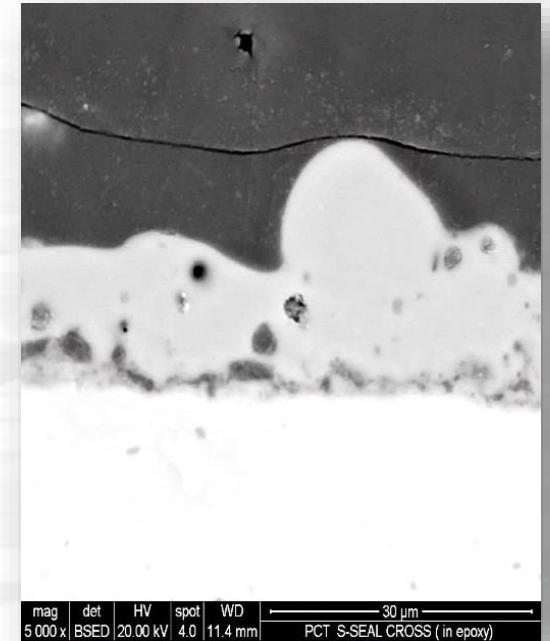


Different examples of short-term projects



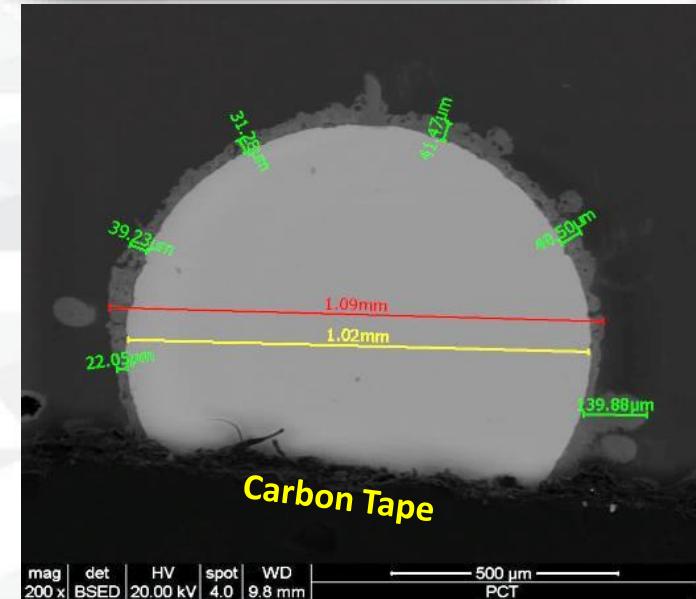
Rapid Electrochemical Assessment of Paint (REAP)

Research & Development - Coatings



Zn-polymer coatings as potential for Cd replacement

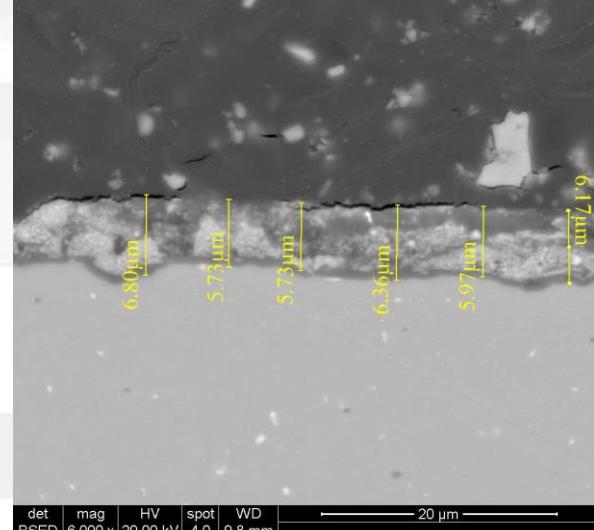
Ni-P with diamonds



Ceramic coatings on metals (MAO)



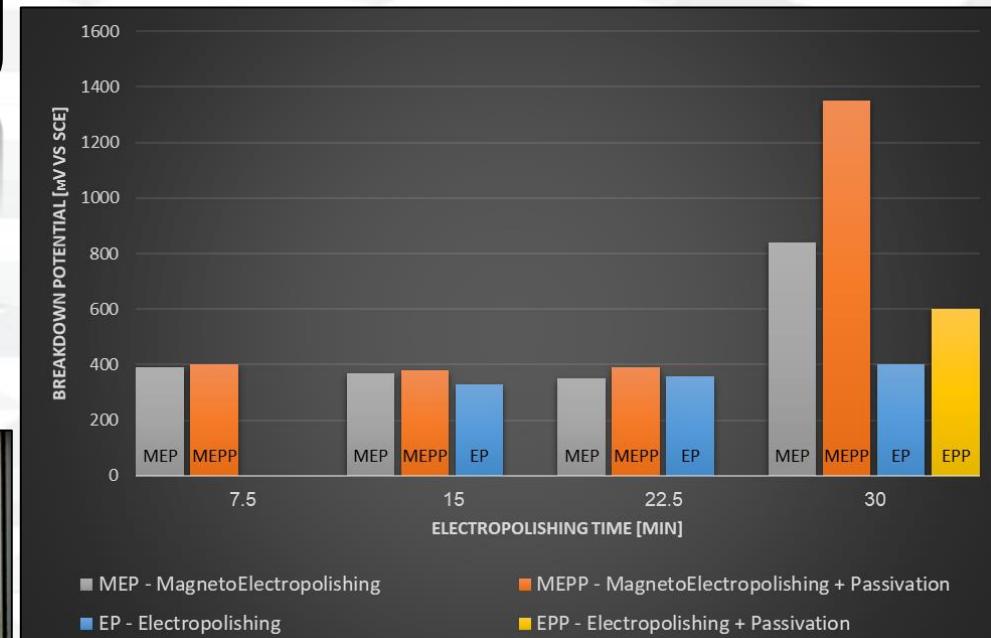
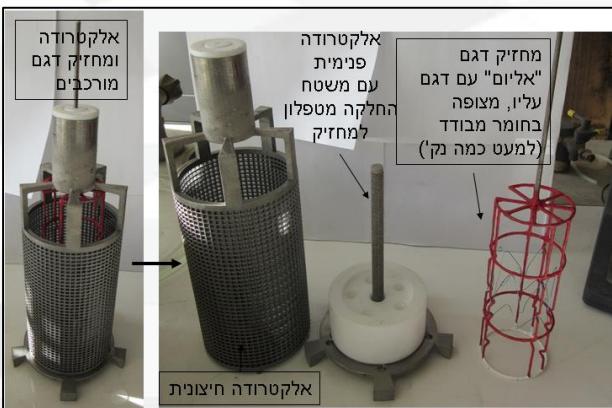
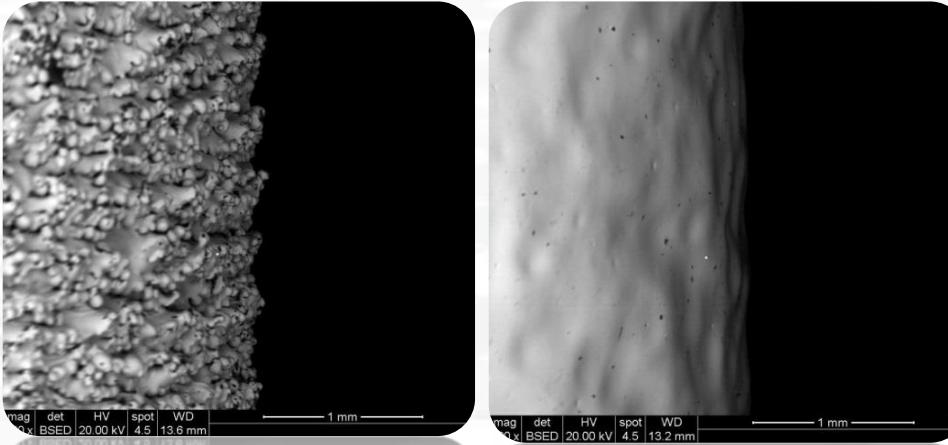
Electrophoretic deposition of ceramic coatings



Research & Development – Advanced polishing techniques

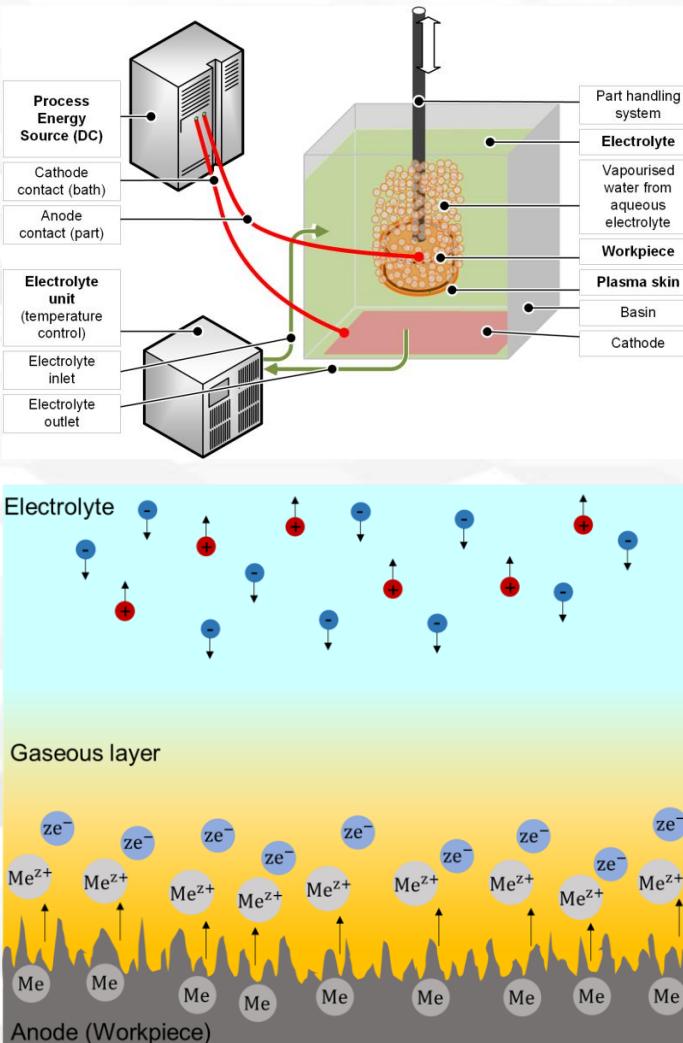


Electro-chemical
polishing (EP)



Magnetic-assisted EP

Research & Development – Advanced polishing techniques



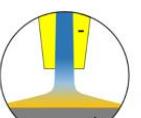
PEP process (St.St.316L/316L VAR)

Plasma EP (PEP)

Research & Development – Advanced polishing techniques



TECHNISCHE UNIVERSITÄT
CHEMNITZ



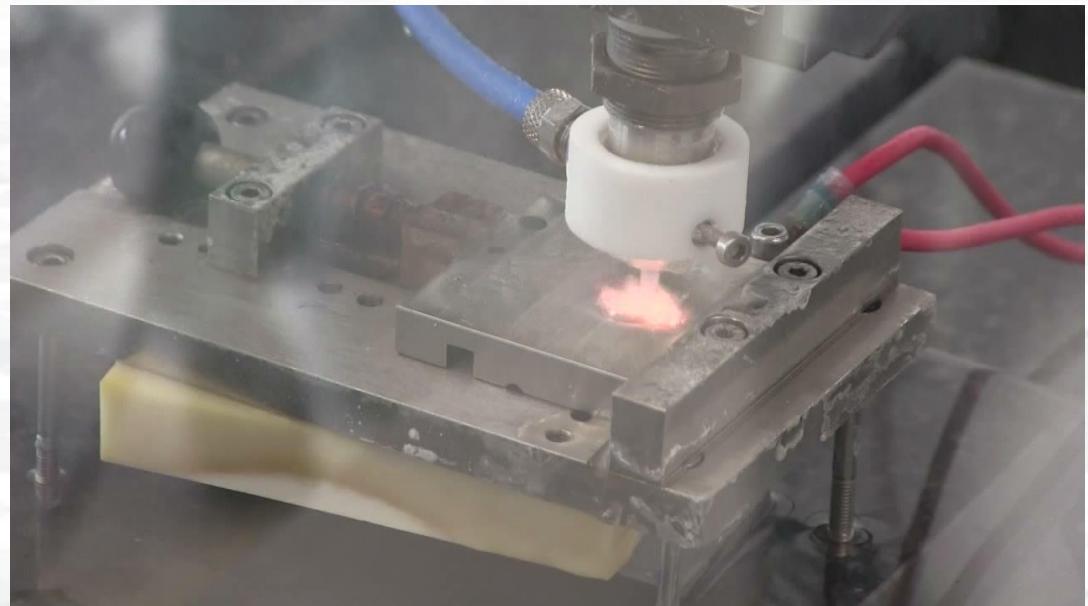
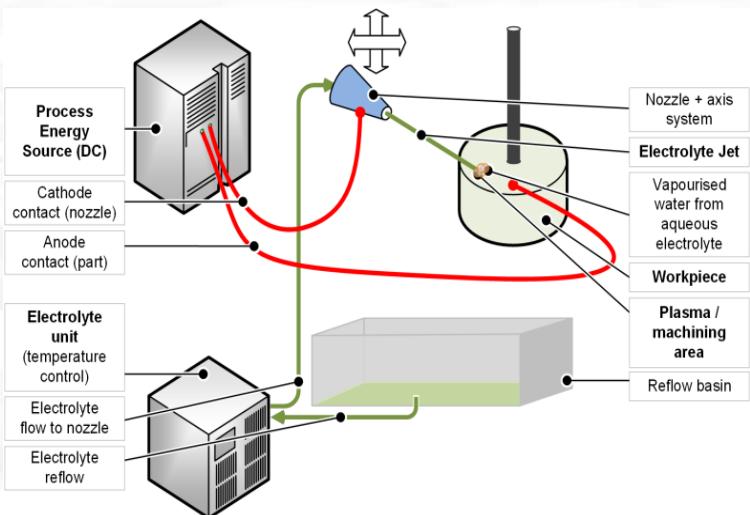
Leukhardt
Schaltanlagen Systemtechnik

BECKMANN INSTITUT
für Technologieentwicklung e.V.

TECHNION
Israel Institute
of Technology



רשות החדשנות
Israel Innovation
Authority



PTKA

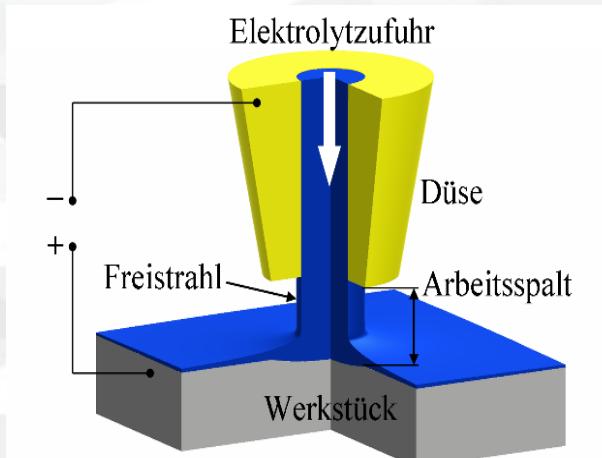
Project Management Agency Karlsruhe

Karlsruhe Institute of Technology

SPONSORED BY THE

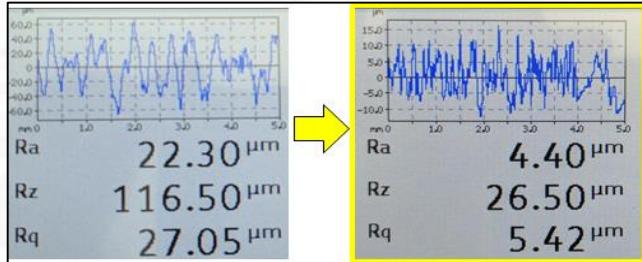


Federal Ministry
of Education
and Research

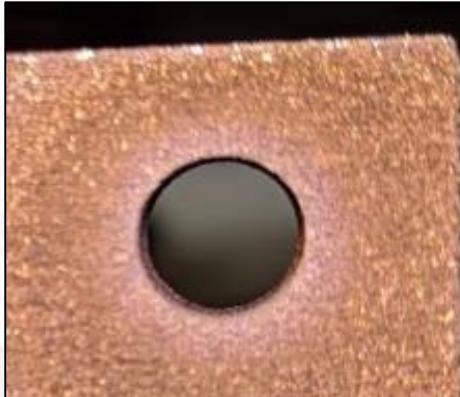


Local PEP (Jet-PEP)

Research & Development – Advanced finishing techniques



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



AMed Ti-6Al-4V drilling



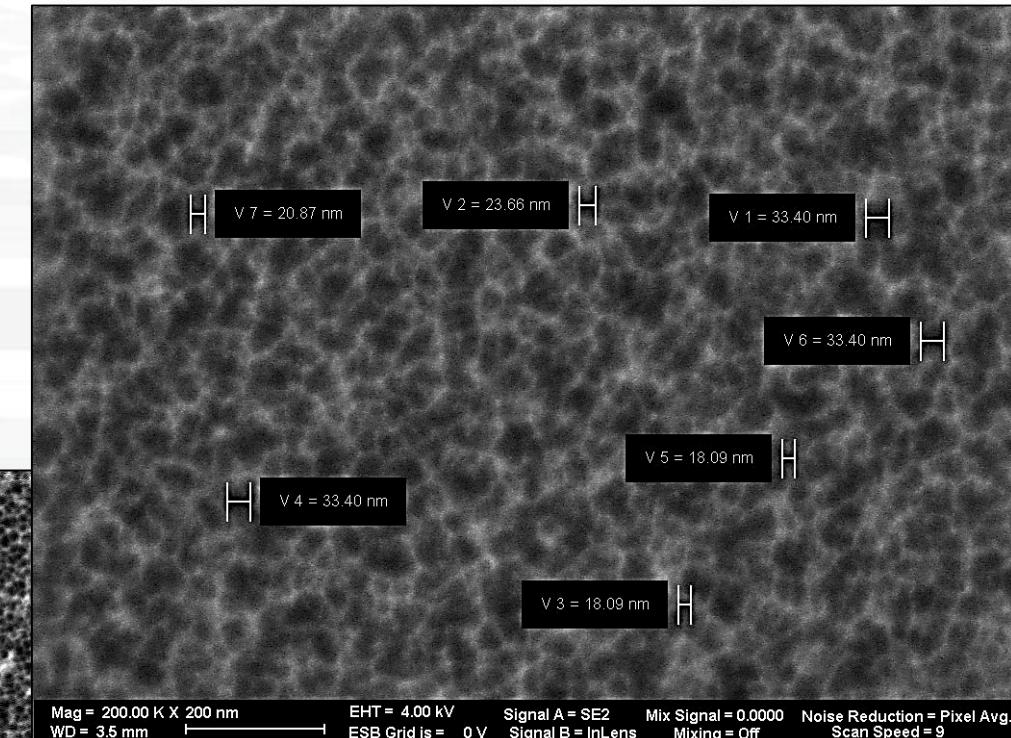
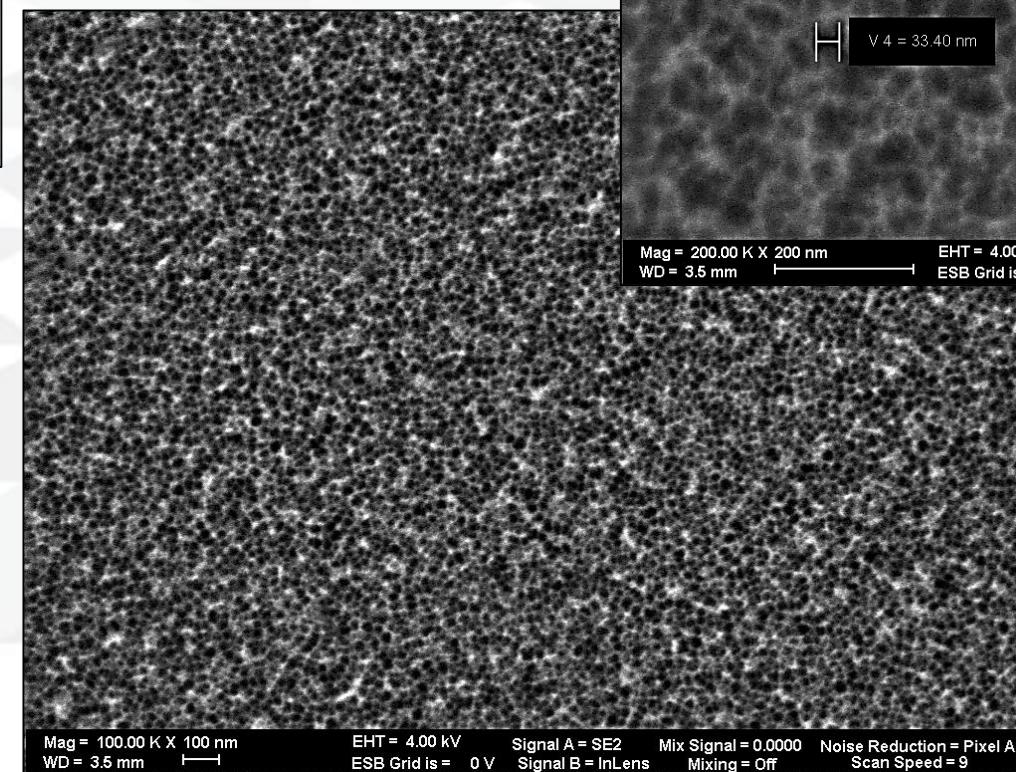
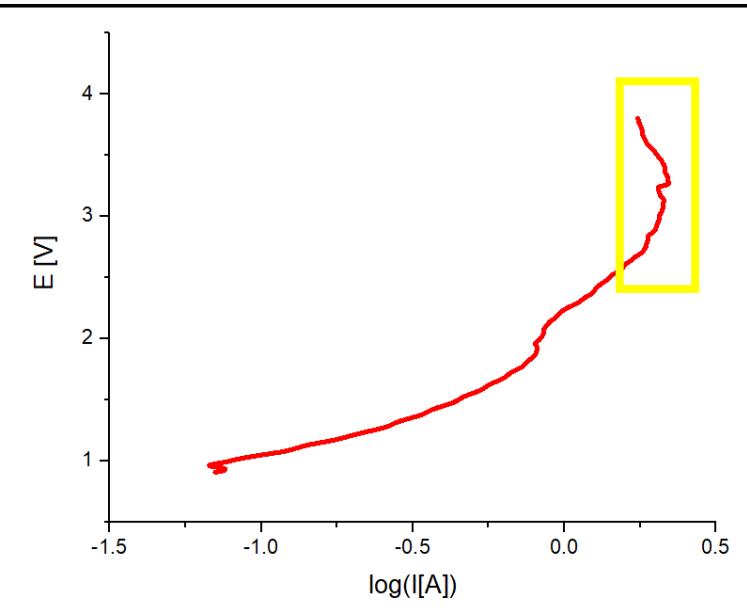
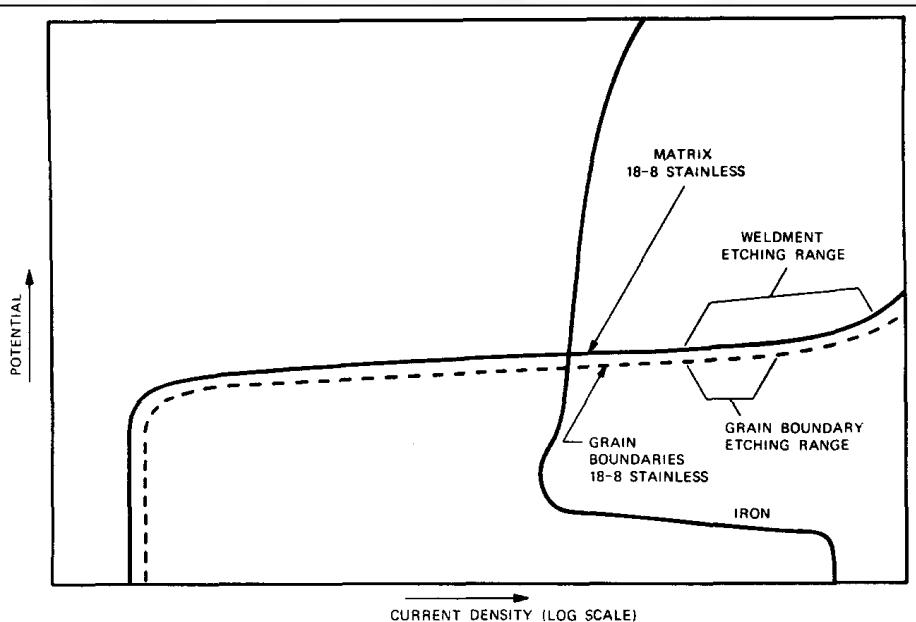
AMed (binder jetting) Si-SiC (CMC) drilling



Electro-discharge treatment

Research & Development – Advanced surface modification

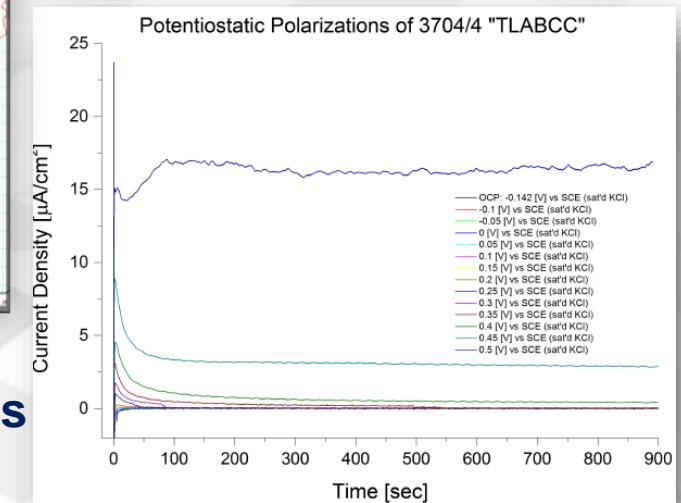
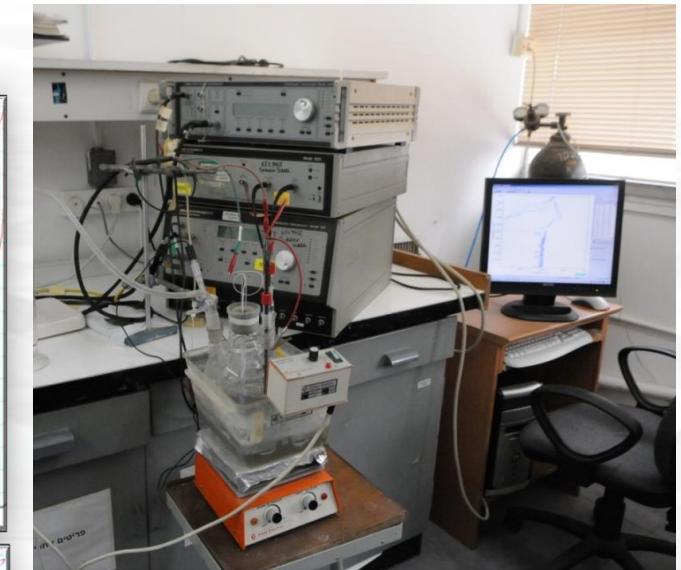
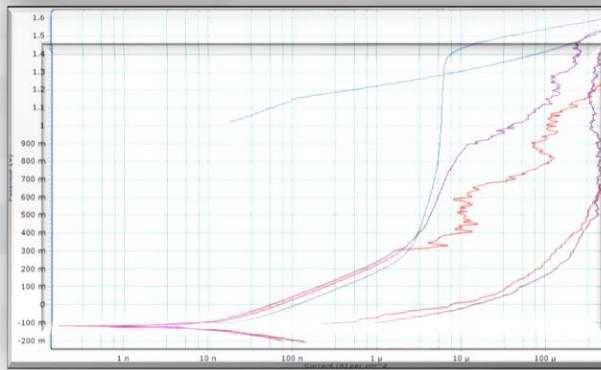
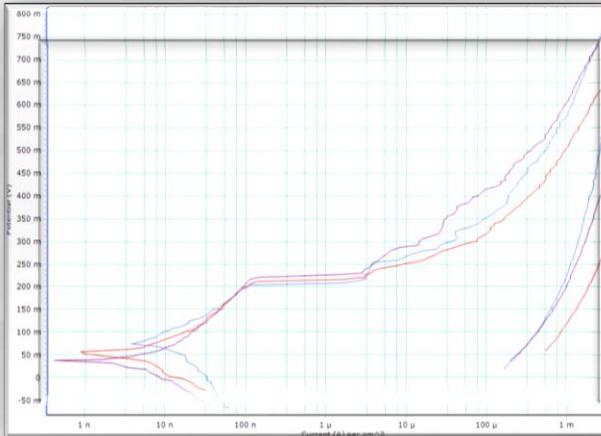
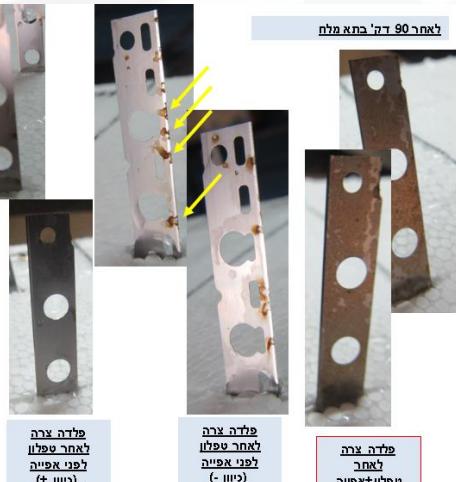
Potentiostatic nano etching of St.St. 316L (for improved osseointegration of medical implants)



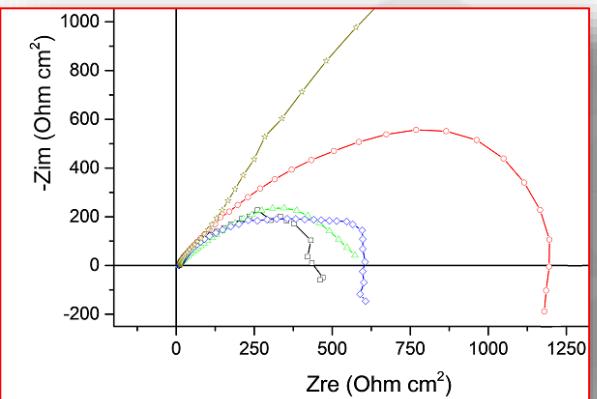
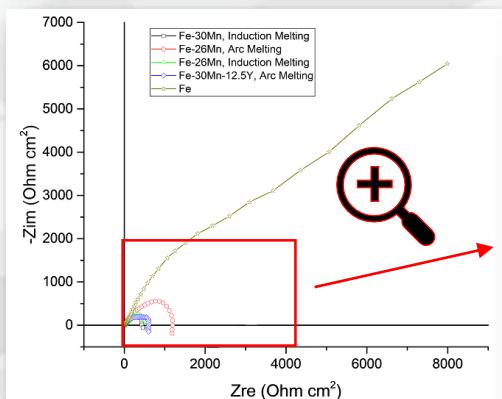
Testing & Characterization



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



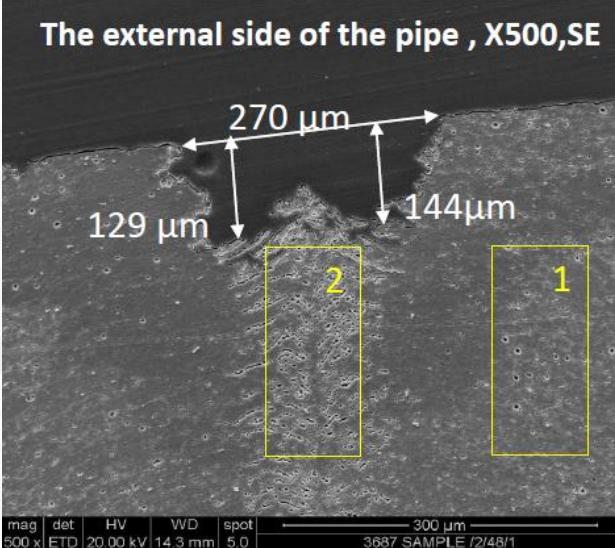
ASTM F-2129: cyclic polarization of nitinol stents



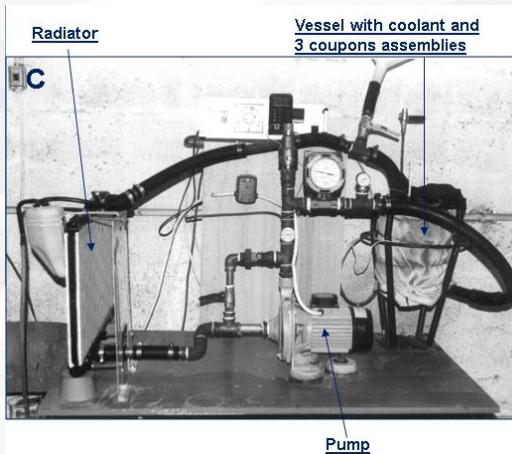
**Nyquist plot:
electrochemical
Impedance Spectroscopy
(EIS) of biodegradable
alloys for medical use**

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

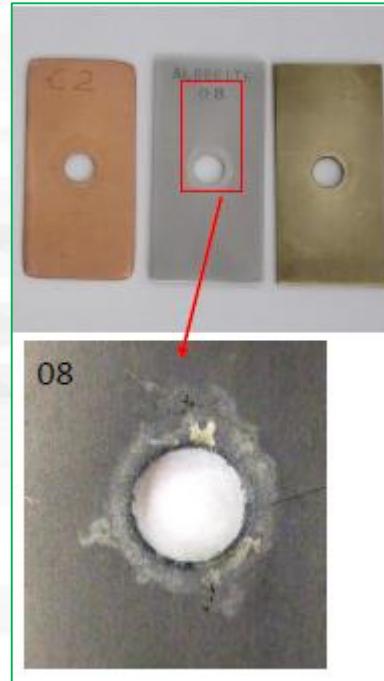
Testing & Characterization



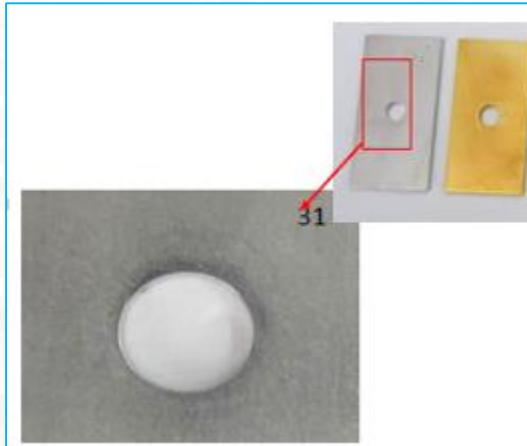
Welding evaluation: chemical resistance of Al5052 tubes in sulfamic acid solution



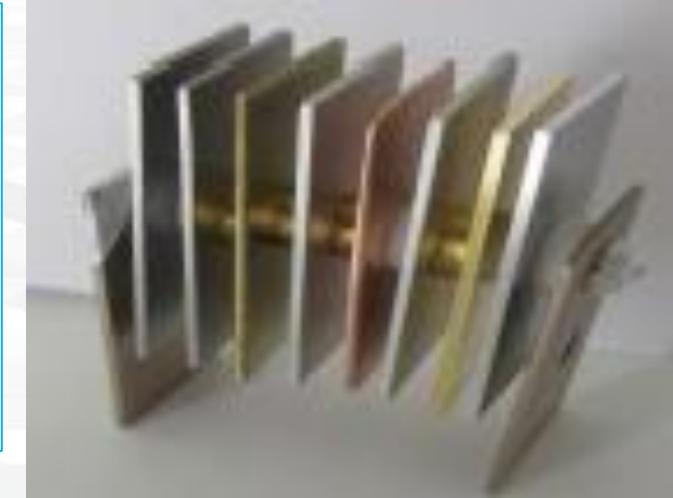
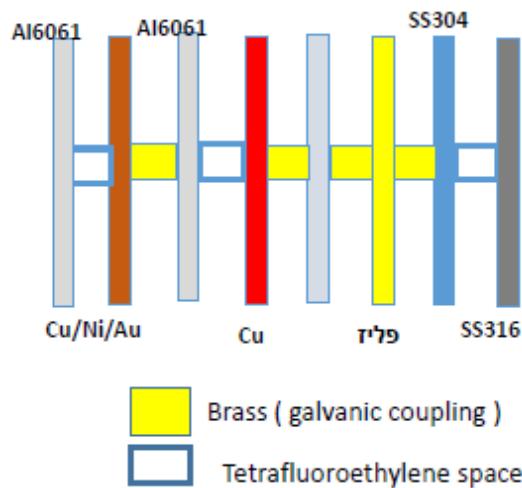
**Performance of inhibitors and coolant requirements according to ASTM 2570
“simulated service corrosion test”**



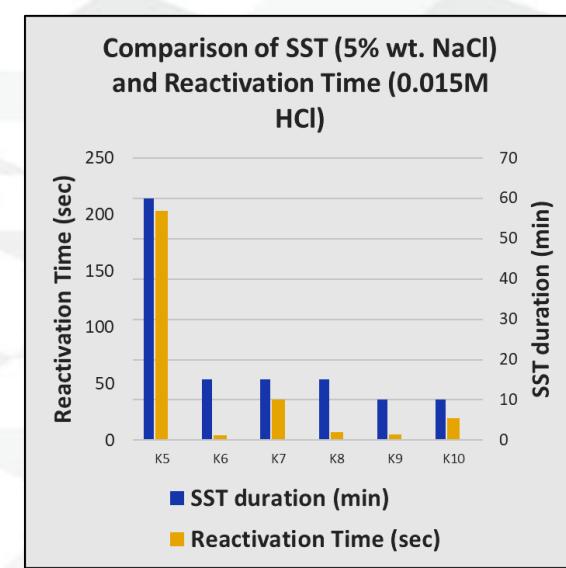
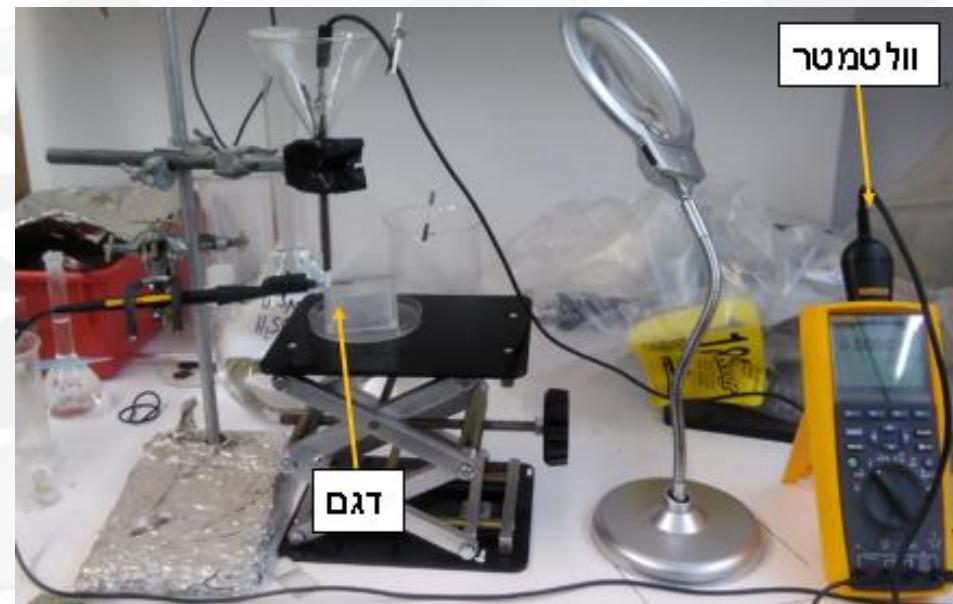
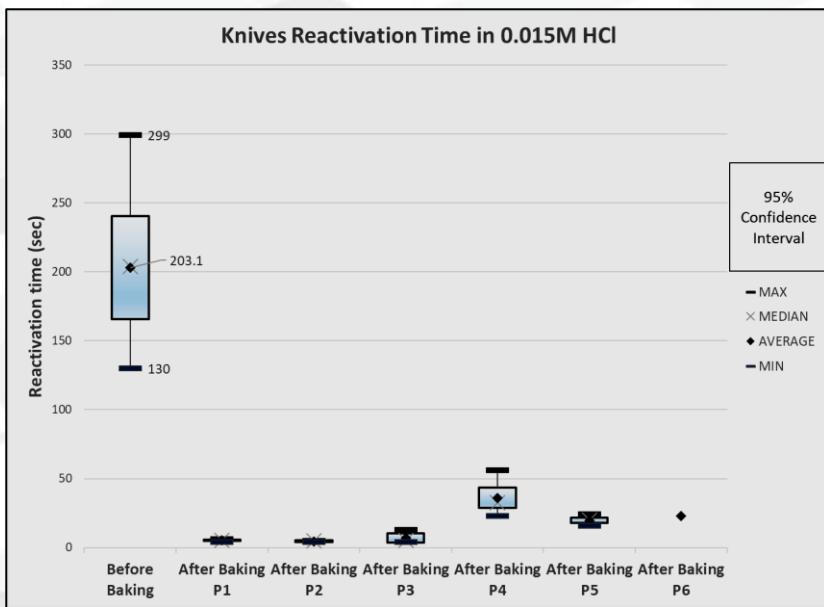
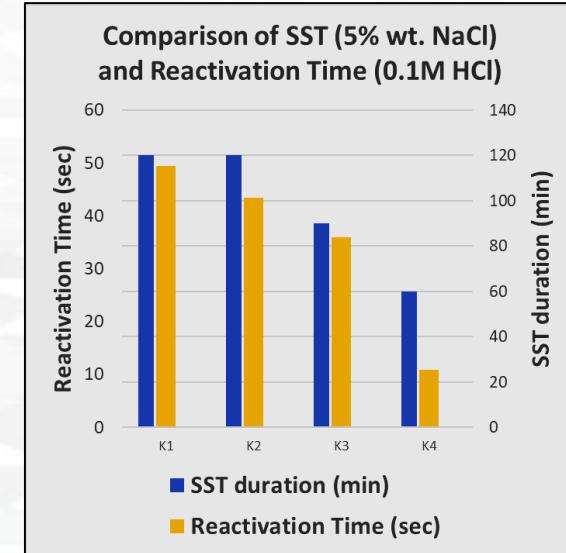
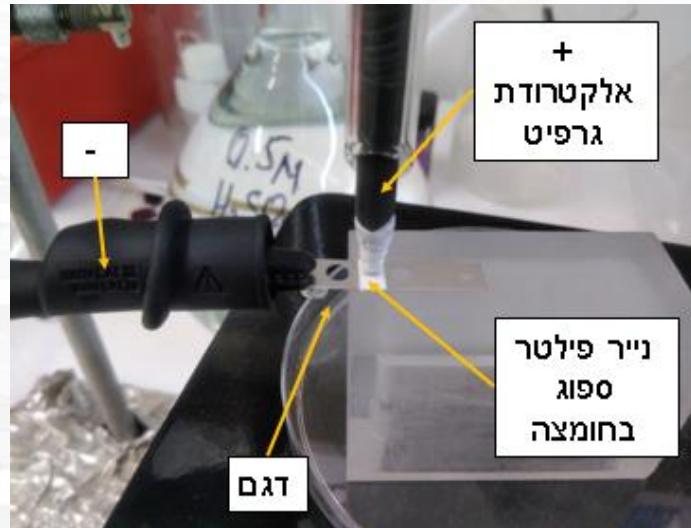
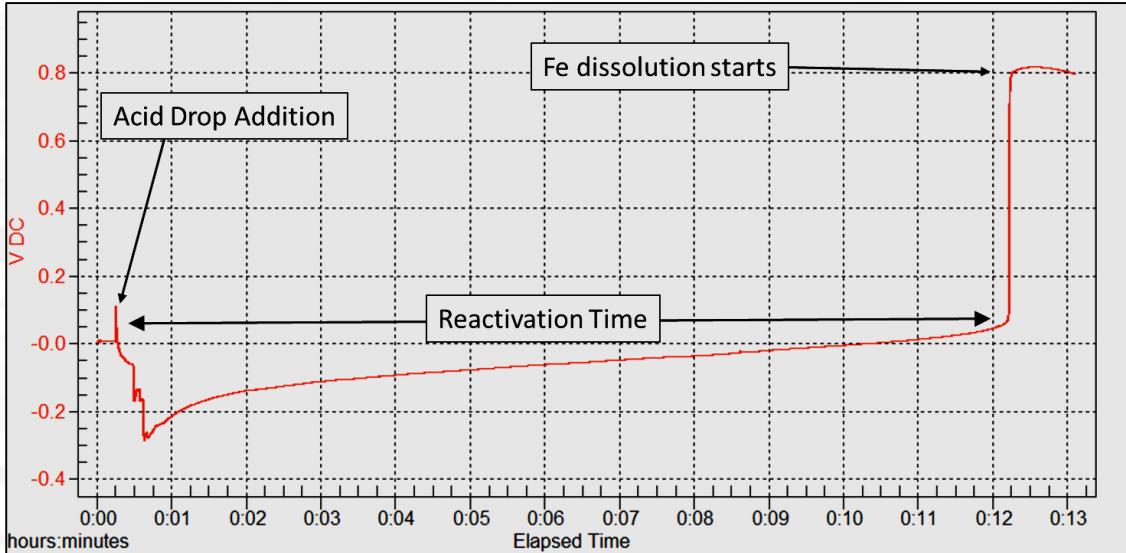
**Galvanic corrosion
Laboratory-scale simulation of laser cooling system (corrosion resistance)**



General corrosion

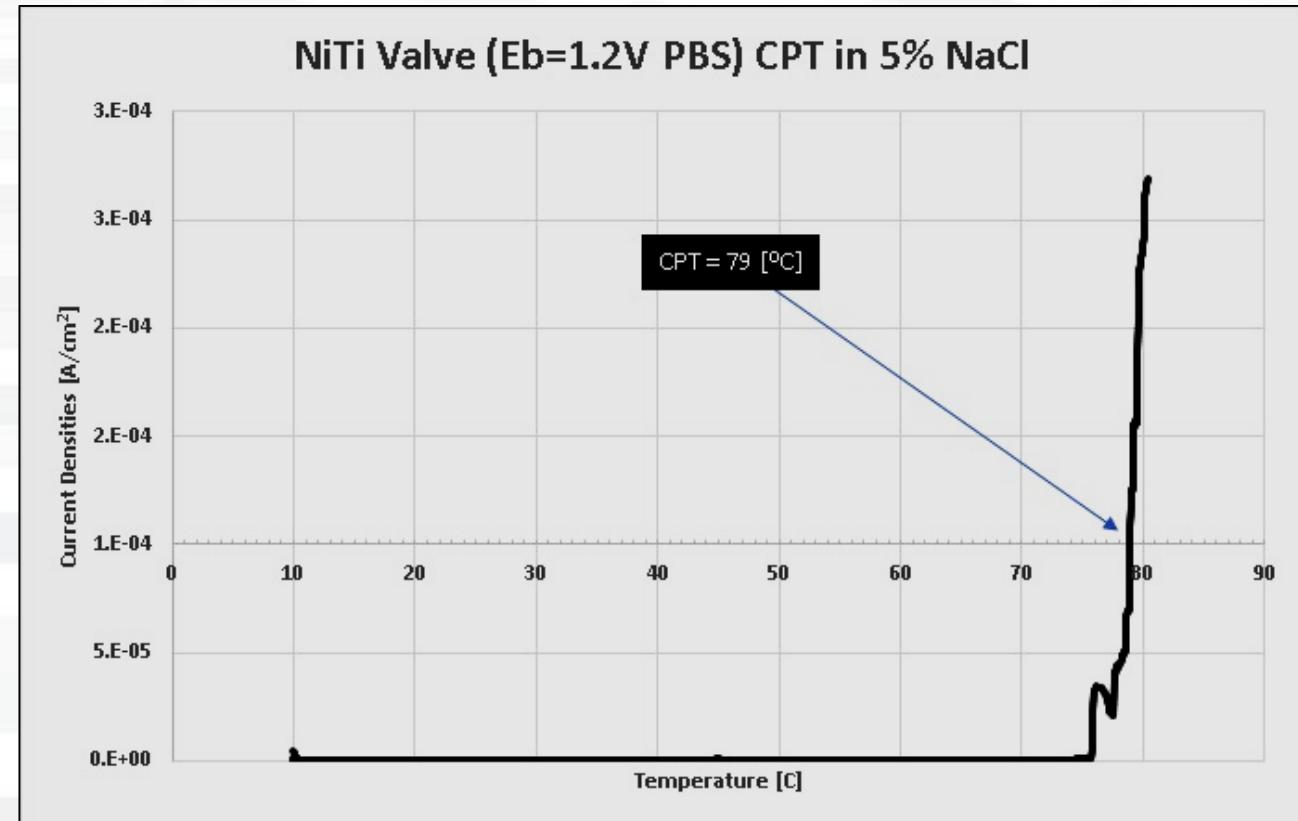
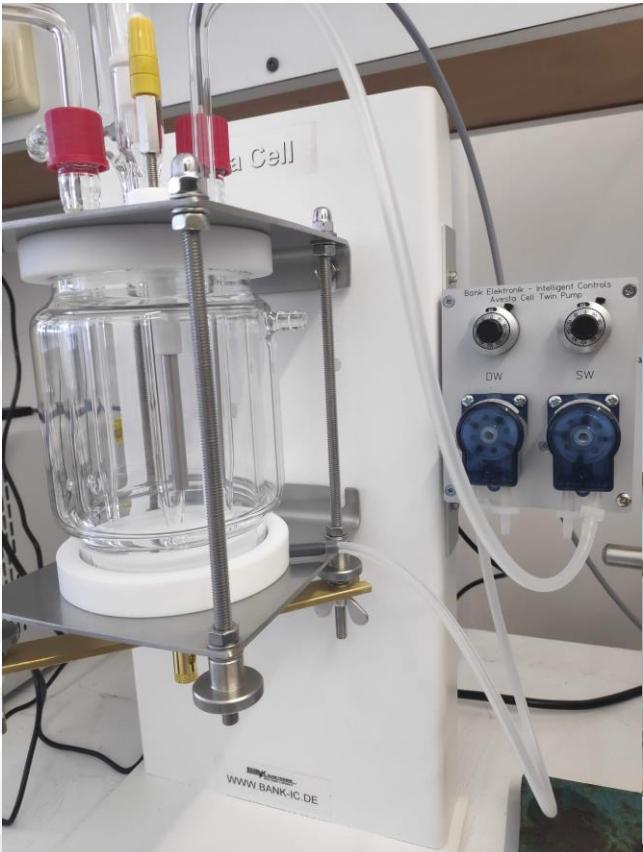


Testing & Characterization



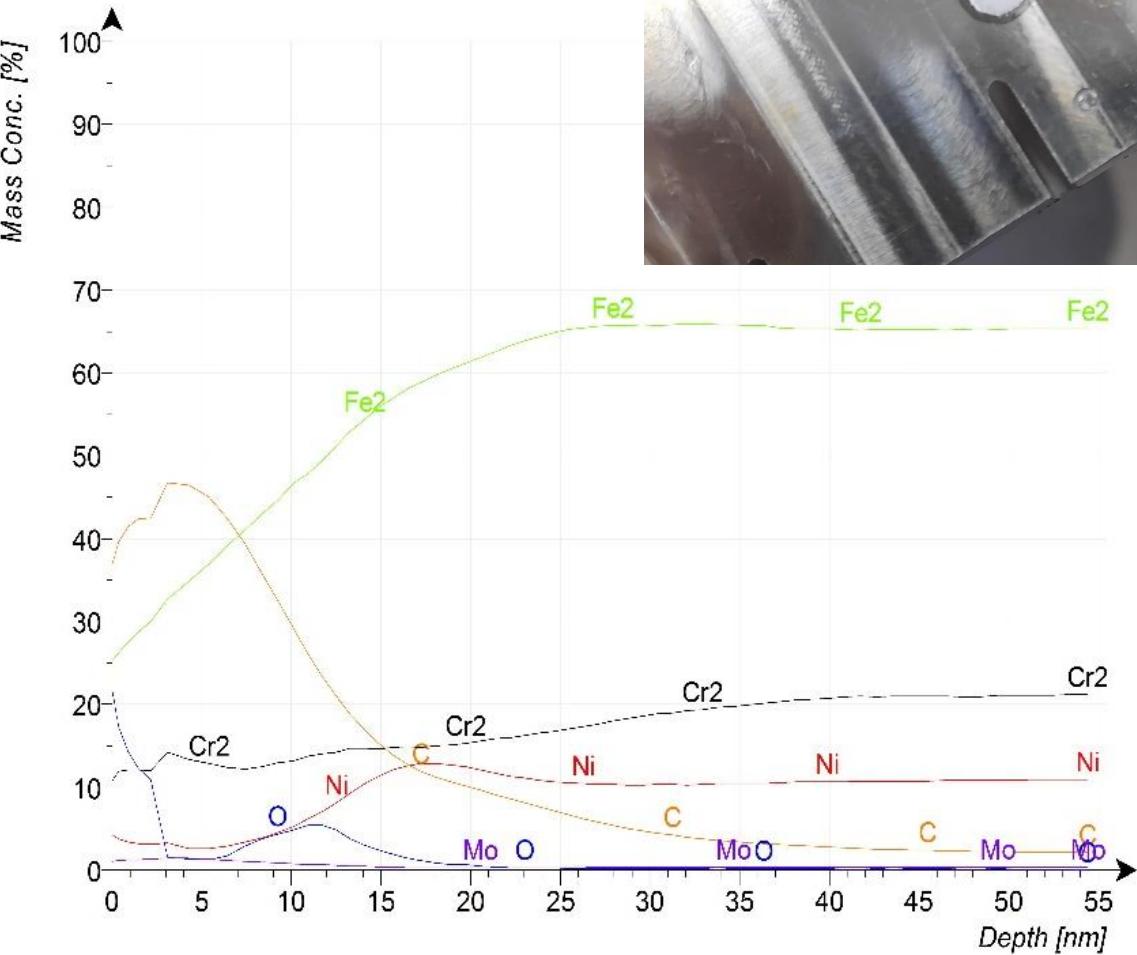
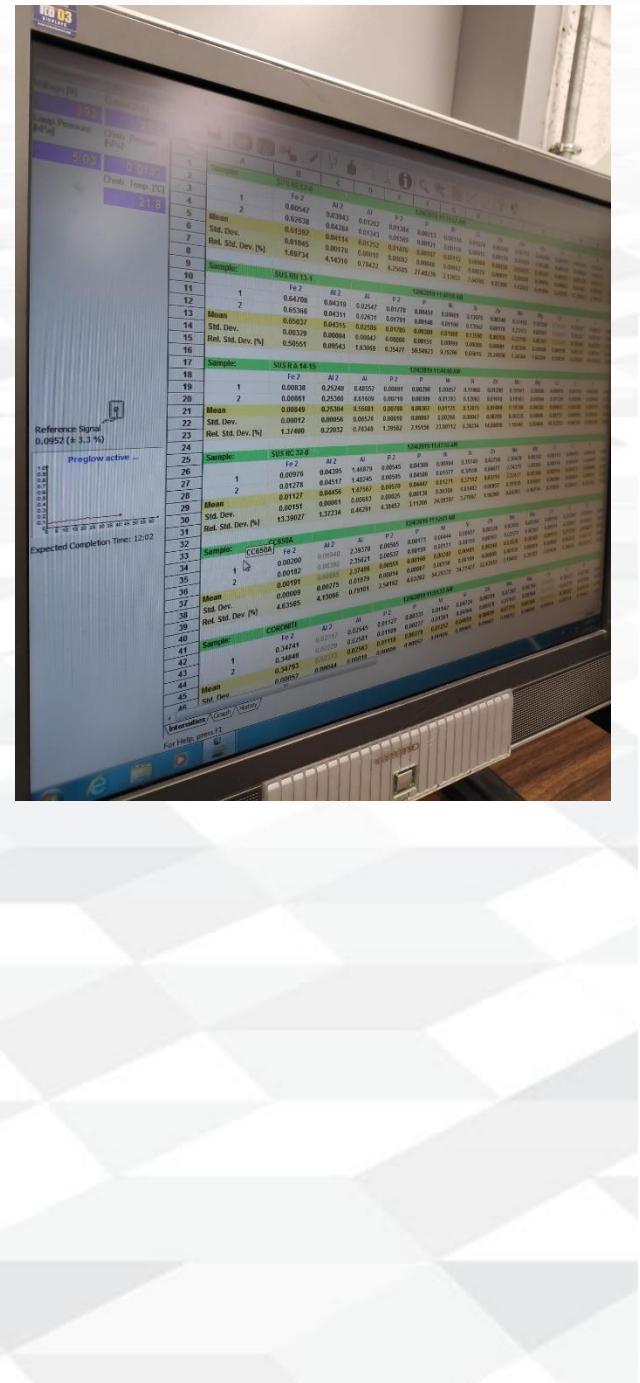
Stainless-steel “quick re-activation test” as substitution for salt spray test (SST)

Testing & Characterization



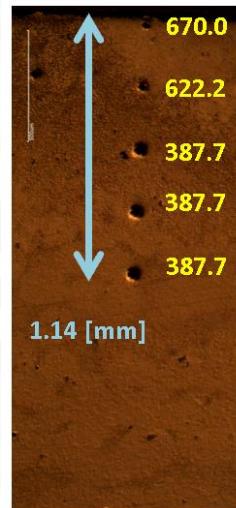
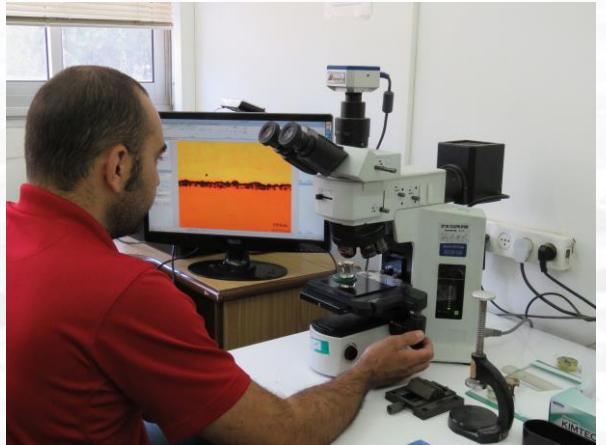
Critical pitting temperature (CPT) with smart heat liquid circulator
(linear or exponential temperature profile with external control)

Testing & Characterization

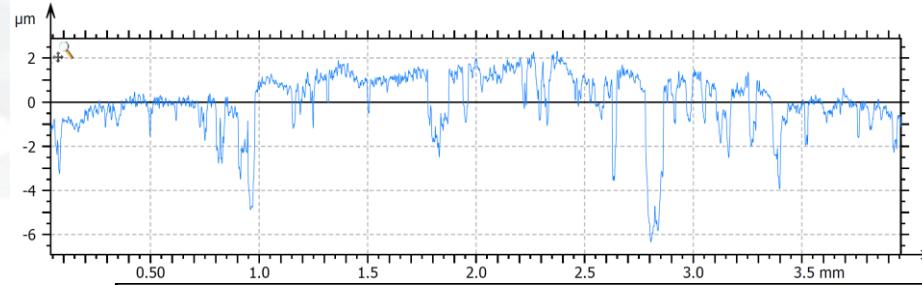


SPECTRUMA
GDA-750
Glow
Discharge
Optical
Emission
Spectroscopy

Other services (just some examples)



G21 Series



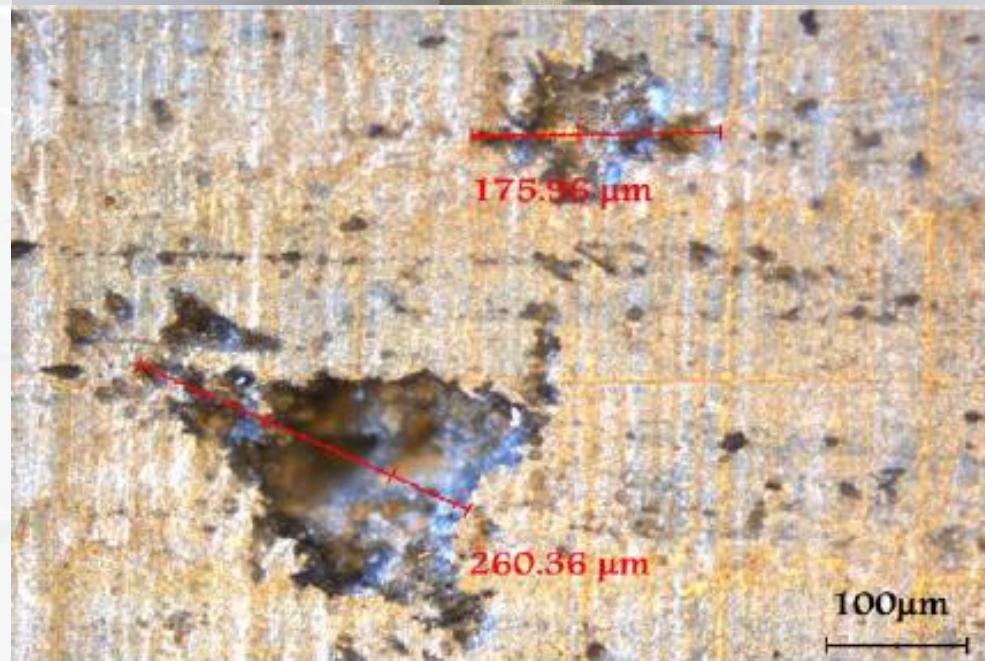
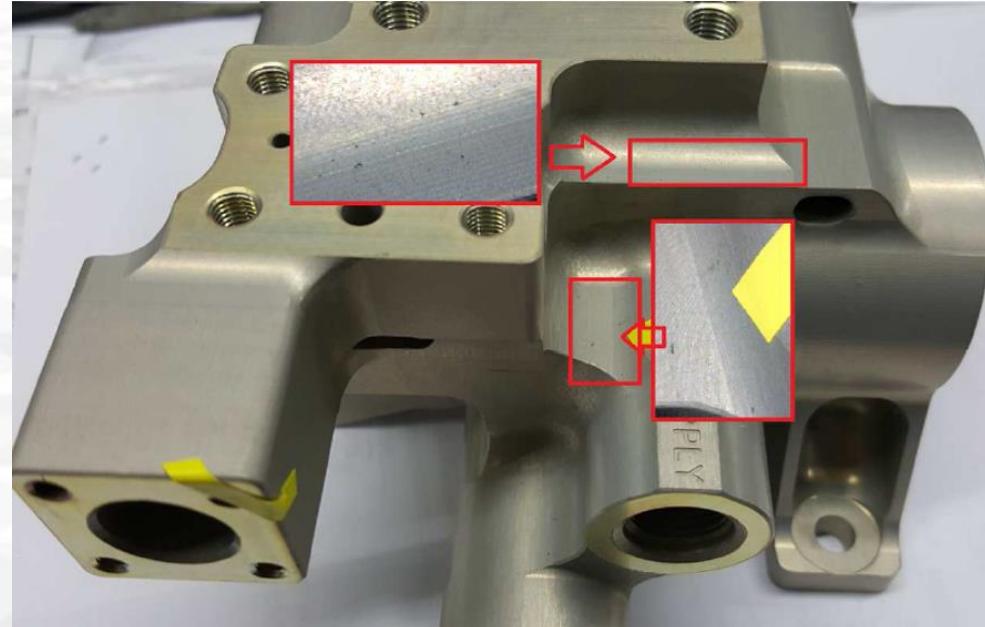
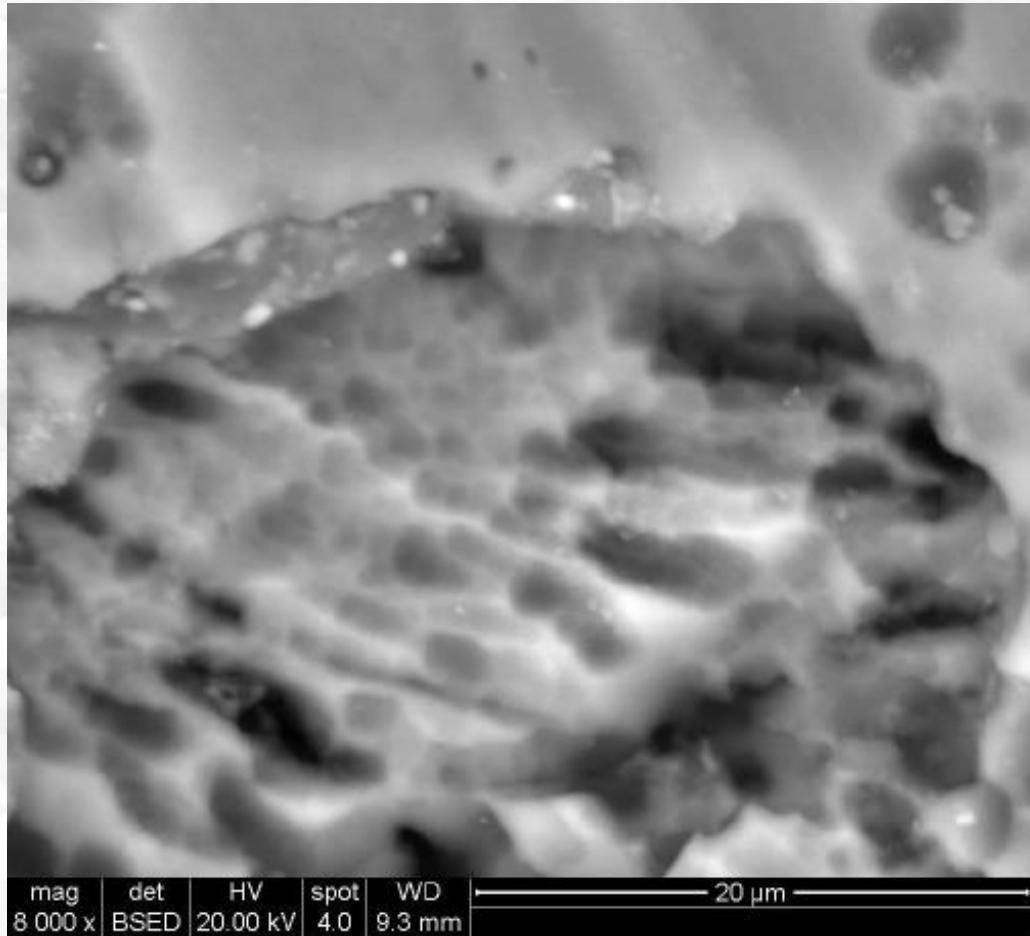
ISO 4287

Amplitude parameters - Roughness profile

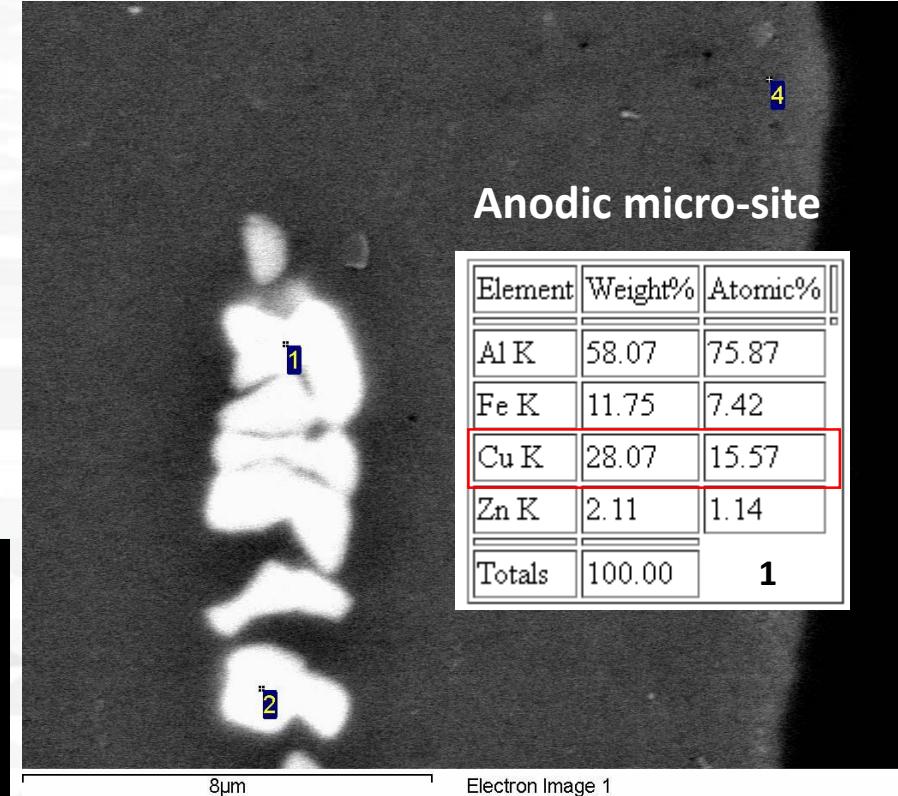
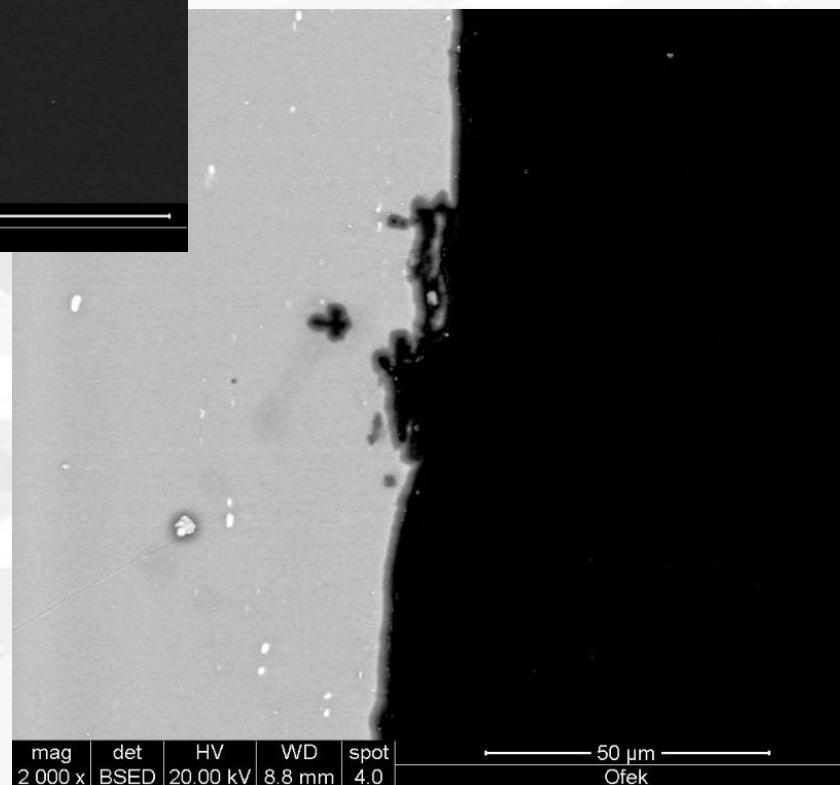
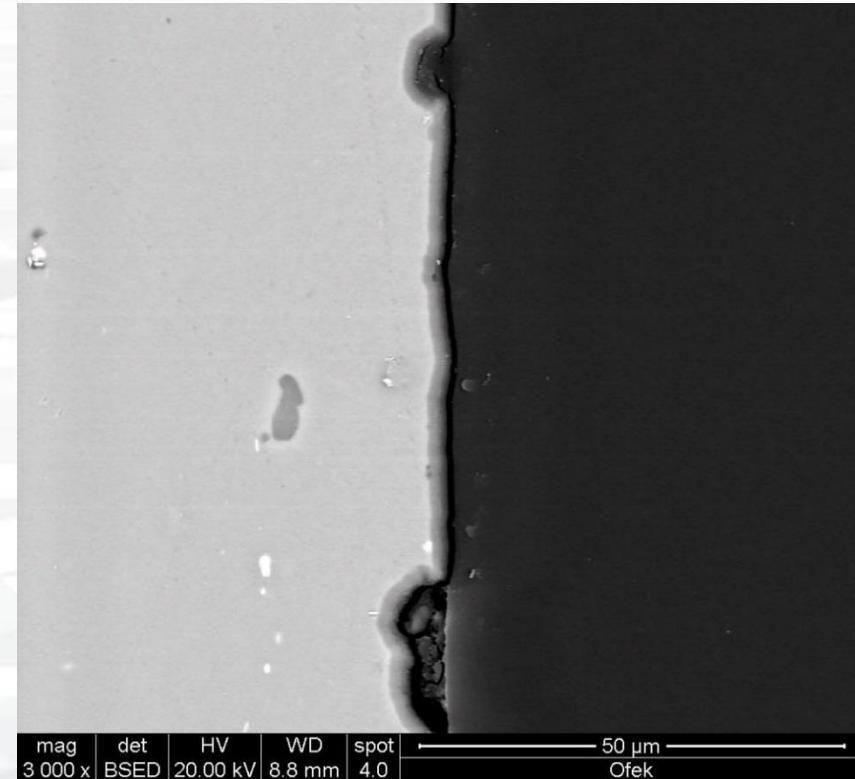
R _a	0.709	µm	Gaussian filter, 0.8 mm
R _q	0.993	µm	Gaussian filter, 0.8 mm
R _z	5.53	µm	Gaussian filter, 0.8 mm



Case study: failure analysis



Case study: failure analysis



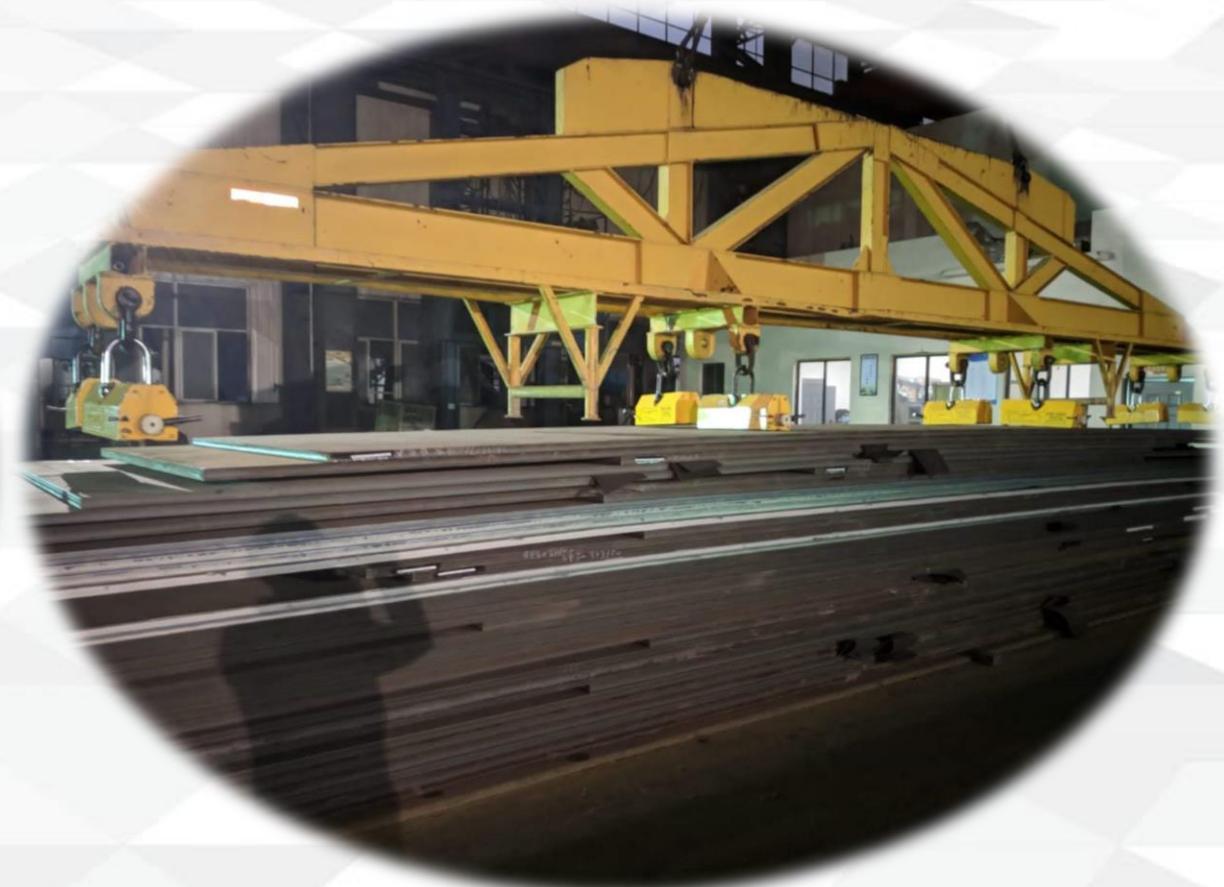
CHEMICAL COMPOSITION LIMITS (WT %)

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



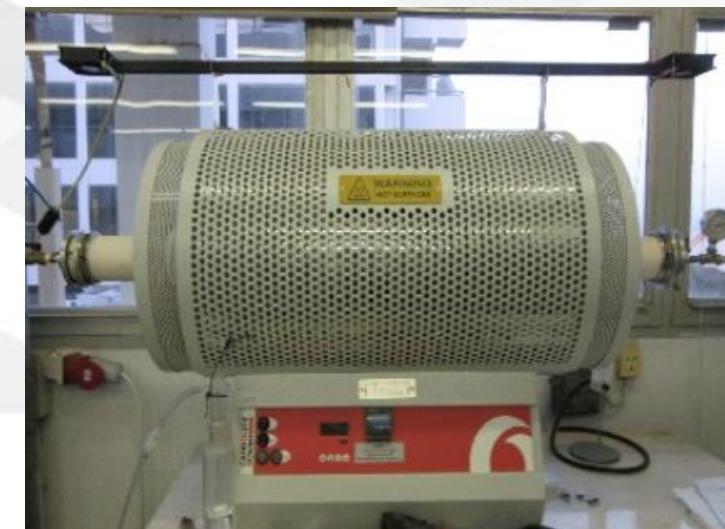
Different Topics



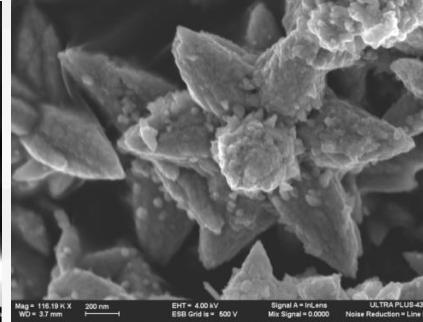
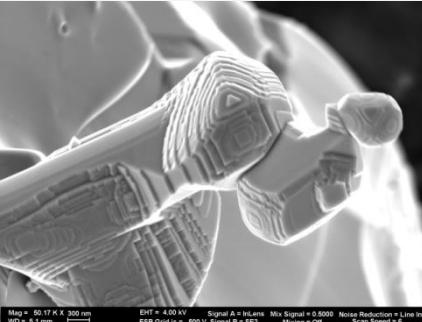
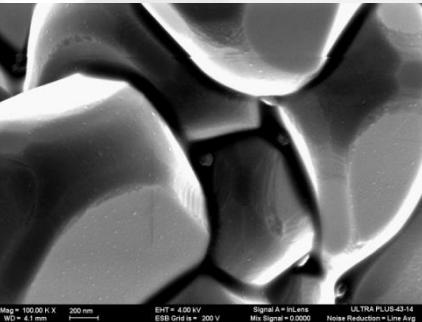
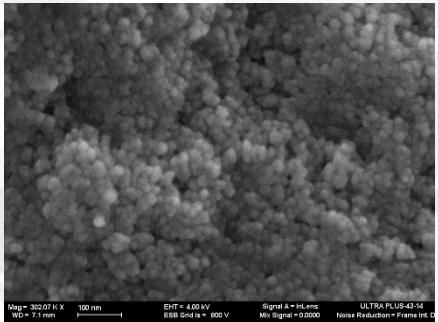
by CyberLink
PowerDirector



Development of 3D printed magnets



Synthesis of magnetic materials

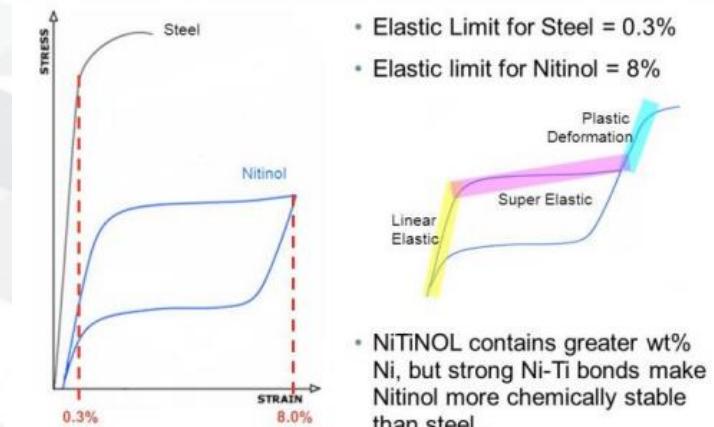
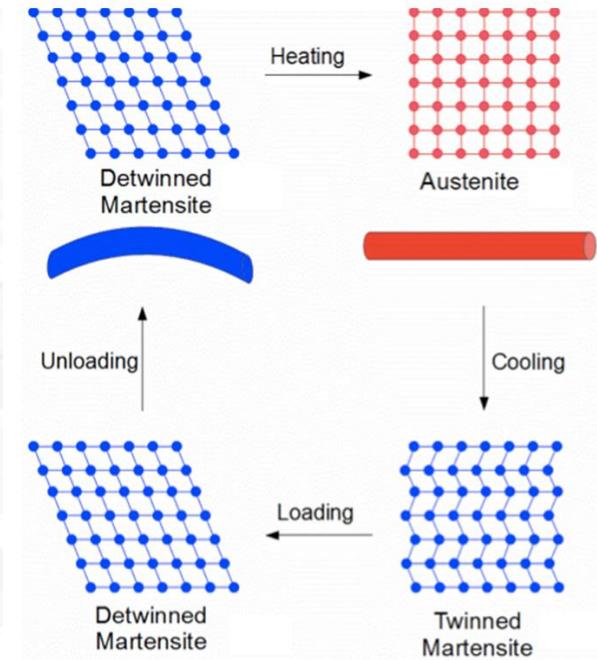
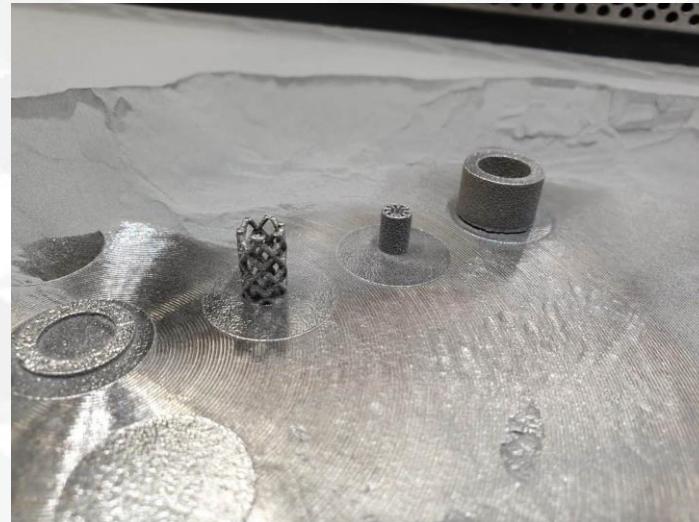


Mag = 116.19 K X EHT = 4.00 kV WD = 3.7 mm ESB Grid is = 500 V Signal A = Int. lens Mix Signal = 0.0000 Noise Reduction = Line Int. Scale Speed = 4.0

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

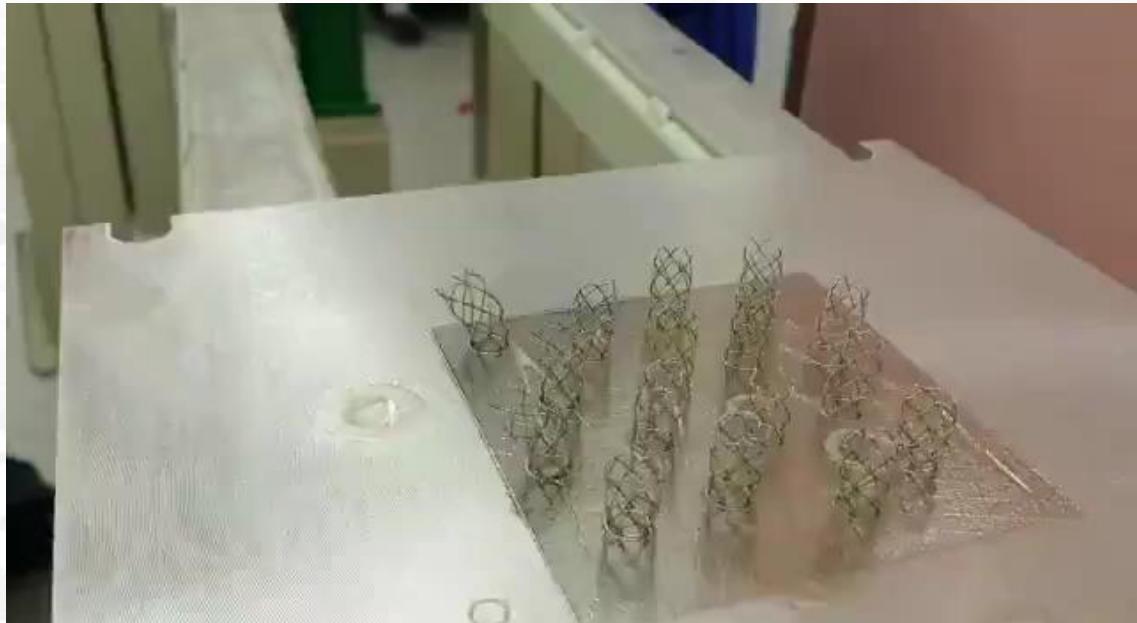


- Elastic Limit for Steel = 0.3%
- Elastic limit for Nitinol = 8%

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	

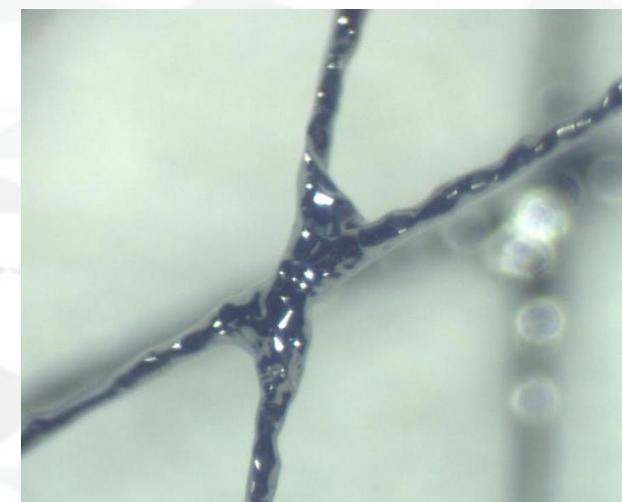
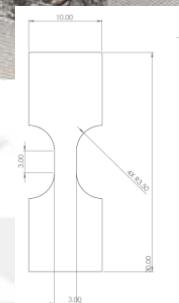
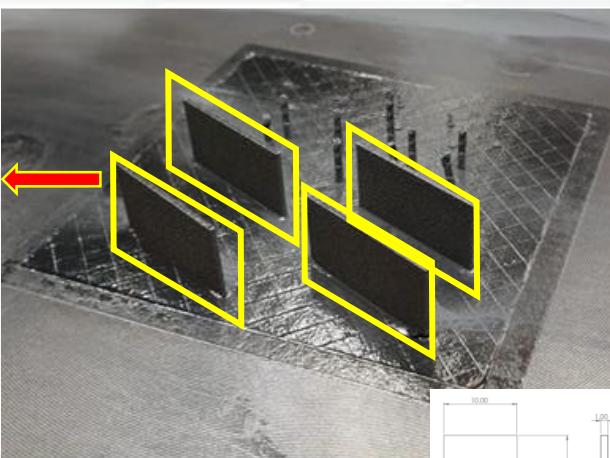
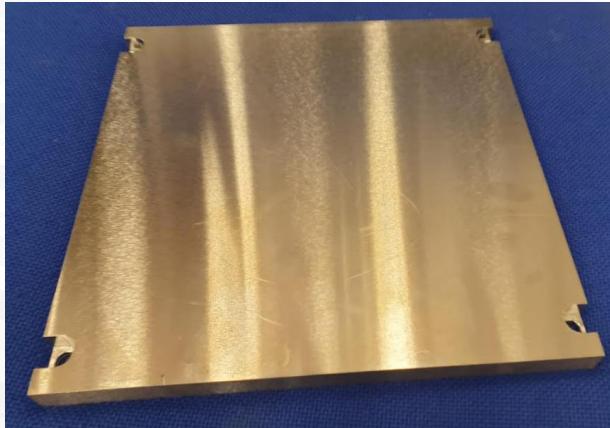
EDS of printed parts

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.

ASTM F2063

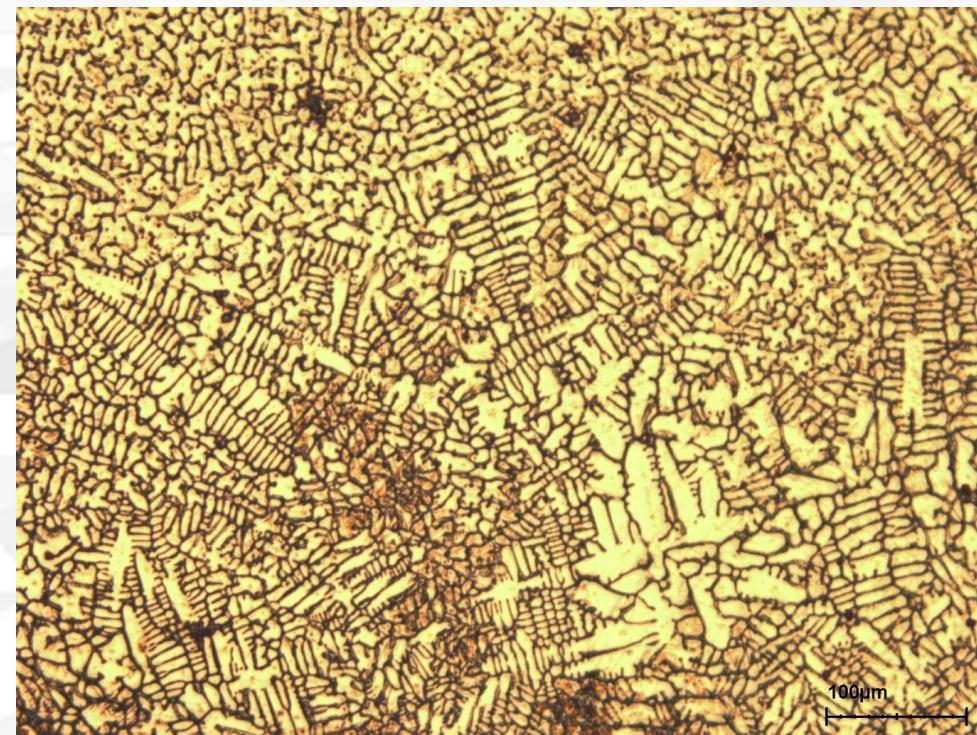
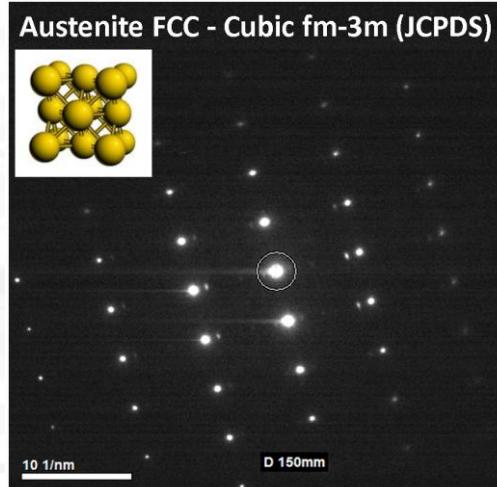
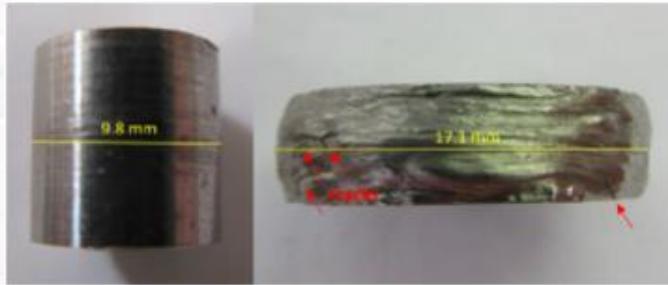
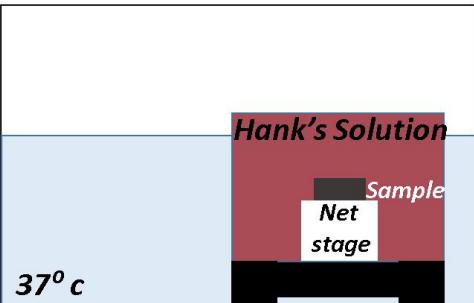


Development of 3D printed nitinol (SMA/super-elastic)

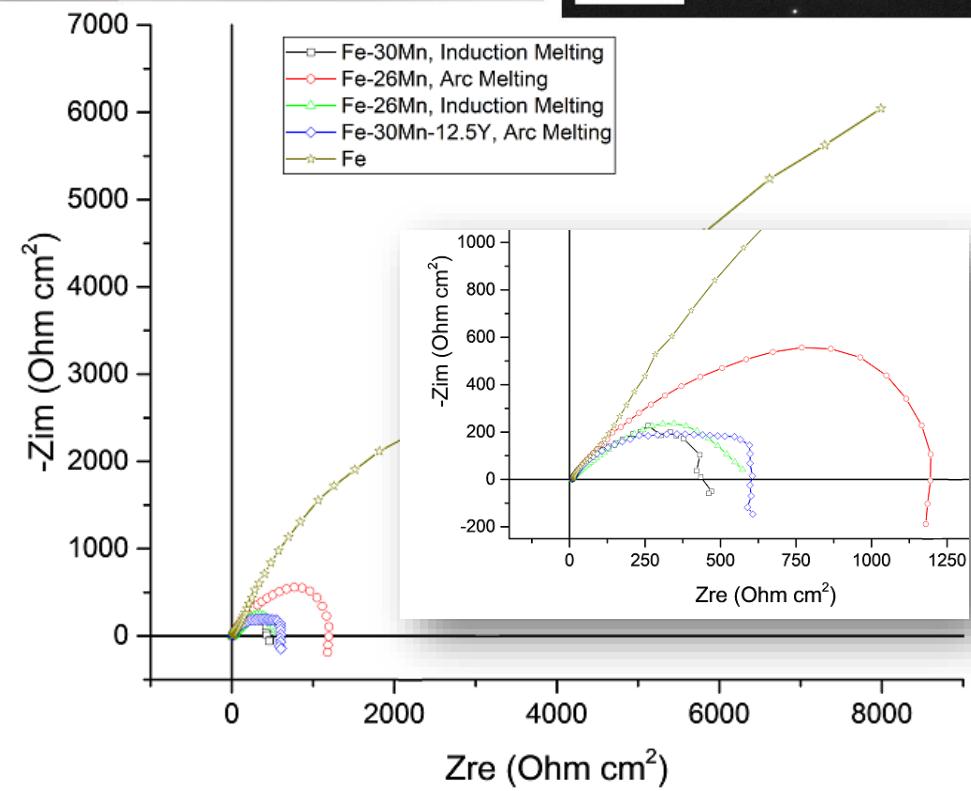
Different Topics



Setup

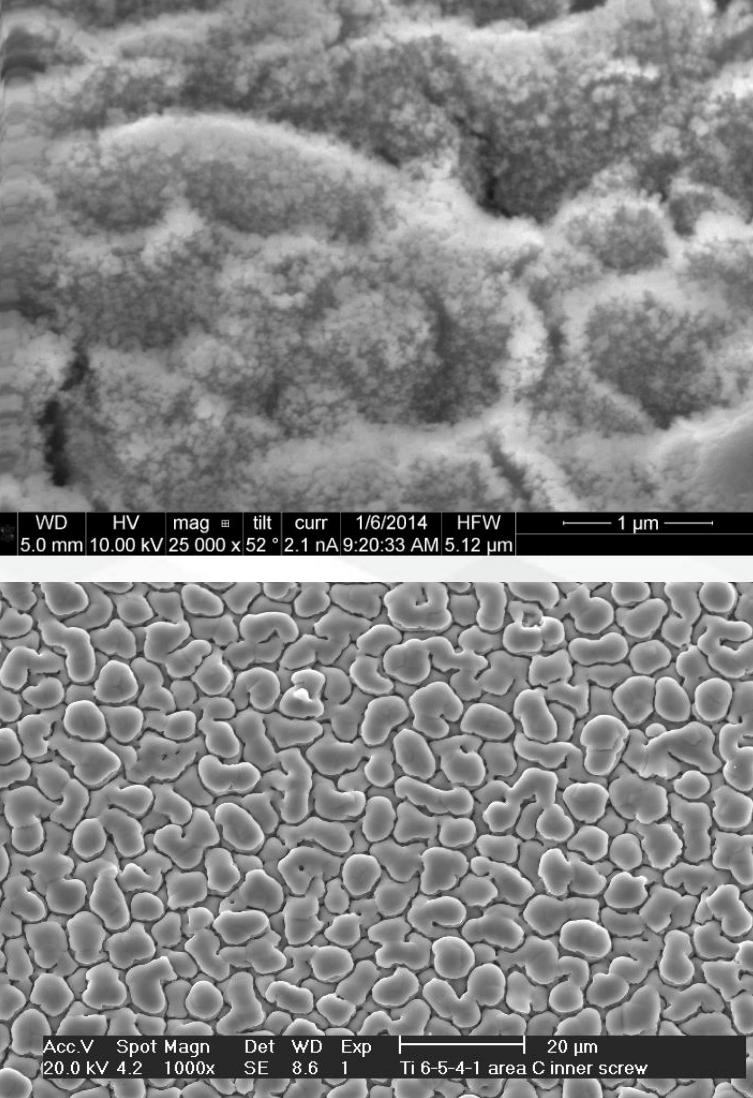
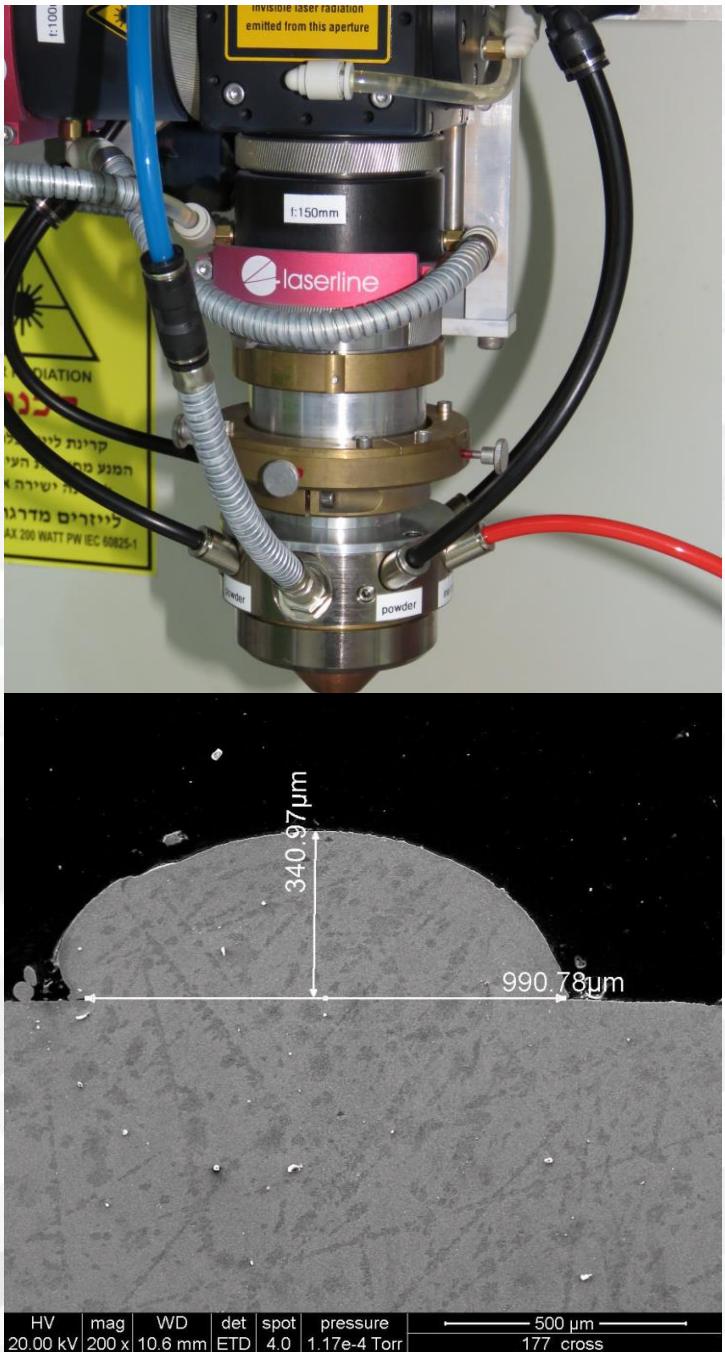


$$CR = \frac{K \times \Delta W}{A \times t \times \rho}$$

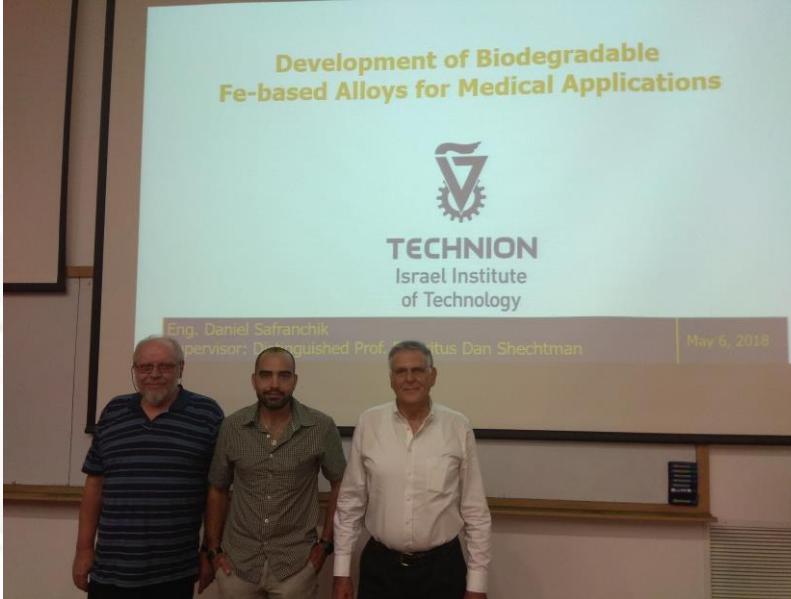


Development of biodegradable metallic implants

Different Topics



Laser technologies



TIME 2018
technological innovations in Metals Engineering
May 30-31, 2018
Haifa International Convention Center | Haifa, Israel

מפגן המדע והחדשנות של ההיינטכון, הרשות לחינוך בשדרות הגליל והטהנייה
אנו מושתים מפגן ווות'ר פורום טכנולוגיות מתקדמות וטכנולוגיות לומדוניה

הכנס הבינלאומי הראשון בישראל
ודשנות טכנולוגיות בענף התעשייה
הכנס נערך בברוחו של אונט-הTMS אקדמי
ובראשתו וכוכב פול פרוף דן שchetman

מפגש בין מומחים בינלאומיים ו/localeים משלבים וsoftmax מומחים מוסמך
נכלה ותעשייה ורשות החדשנות ורשות החדשנות
בן שוחט האגודה, רשות החדשנות ורשות החדשנות ורשות החדשנות
וכוכב גלובלי ורשות החדשנות ורשות החדשנות ורשות החדשנות
תולביב, פיקוד, מילימטר, ורשות החדשנות ורשות החדשנות ורשות החדשנות

SESSION VI
09:00 Coffee Break
09:30 Session I: The challenge under extreme conditions
Santiago Cuesta-López
International Research Centre in Critical Raw Materials, Advanced Materials, Nuclear Technology
Burgos, Spain
UIC-154, University of Burgos, Hospital del Rey s/n, 09001 Burgos, Spain

SESSION VII
10:00 High temperature thermophysical properties of
Einaid Strumza, Shmuel Hayun
Department of Materials Engineering Ben Gurion University
10:15 Micro Arc Oxidation - Advanced Surface Protection
Daniel Safranchik¹, Dr. Inbar Dag², Daniel Godlewski
¹Technion Institute of Technology; ²PCT, Protective Lab, Israel Institute of Metals, Technion R&D Foundation

SESSION VIII
10:30 Coffee Break
11:00 EU strategy on Critical Raw Materials
Godlewski
Commission, Directorate-General for Energy, Brussels, Belgium

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SESSION LVII
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SESSION LVIII
535:30-536:30
SESSION LVII
536:30-537:30
SESSION LVIII
537:30-

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 הῆגשה	קניין ותמלוגים	הערות
הכוונת ידע: נופר קמין	ביצוע מחקר מדעי לאור צרכי התעשייה	10-90 0-85	עד שנתיים (הגשה שנתית)	2-3 פעמים בשנה	ברשות הטכניון, זכות ראשונים למפעל	טכניון אקדêmיה
מכינת המו"פ	בדיקת התאמה לתיעוש	75% מימון עד 100,000 ₪ לאזרור פיתוח א, מתוכם 40,000 ₪ ישולם למכון Ciיעוז	מסלול לתקופות 9 חודשיםCiיעוז	חופשי	לא תמלוגים	הליך אישור מוצר, טוב לסקר שוק, בדיקת יתכנותות וכו'
העברת ידע: מגנטו	תיעוש ידע מהאקדêmיה	% 66 מימון לכלל התקציב ע"י הרשות, התשלום למכון המחקר ע"י התעשייה ולאחר השלמה לו- 100% תקרה 3.4 מ' ₪ לשנתיים	עד שנתיים (הגשה שנתית)	2-3 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 המו"פ	פיתוח טכנולוגיות בתעשייה	+ 10% שותפות מכון ב- 20% לפחות + 10% אזרורי פיתוח ללא תקרה, לרוב מאושר סכום סביר 1.2 מ' ₪ לשנה	עד שלוש שנים (ממוצע שנתיים)	חופשי	הידע שייר לתשעה, תמלוגים מול הרשות עד סכום ההשקעה במידת ההצלחה (מהגידול היחסיב במכירות), * פטור לתשעה מסורתית עם הכנסות עד 70 מ' דולר בשנה הקודמת להגשת (לרוב עד 3 הגשות ב-5 השנים האחרונות)	tabniot yizorim ud taka'ra shel 500,000 ₪ ricishet yidu macho'el ud taka'ra shel 250,000 ₪ hozotot fitoch miconot yizor ricibim labniet miconot yizor (ab tipof) ud taka'ra shel 500,000 ₪ drakot le'obdim ud taka'ra shel 25,000 ₪ shi'ok ud taka'ra shel 15% matkatzib ha'tik

מימון ישיר של מזמין הפעילות (100% תעשייה), הידע של התעשייה או בהתאם להסכם אחר עם הטכניון

מימון ישיר

The team



Daniel Safranchik
Head of the lab



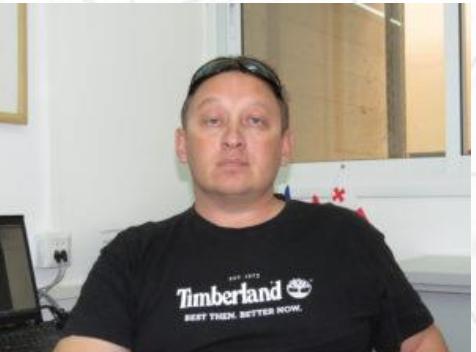
Alla Pismenny
Research engineer



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

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