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relyon plasma
A TDK GROUP COMPANY

piezobrush® PZ3

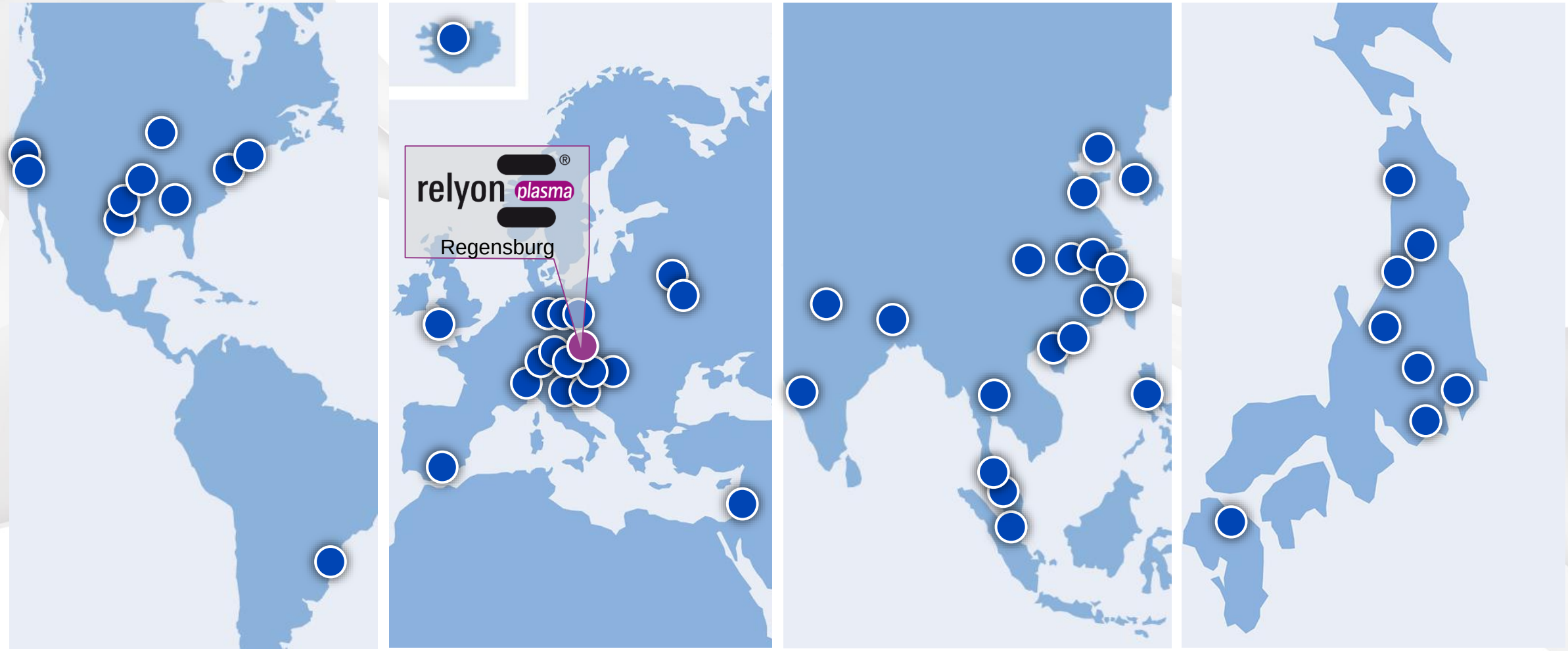
The world's smallest plasma handheld device with PDD technology®

TDK global production and R&D presence

piezo brush® PZ3

TDK production and R&D location

relyon plasma R&D location



relyon plasma international

piezobrush® PZ3

History of relyon plasma

piezobrush® PZ3

- 2002 Founded as **Reinhausen Plasma GmbH** by Maschinenfabrik Reinhausen.
- 2006 First **plasmabrush®** delivery.
- 2009 First **piezobrush®** delivery.
- 2010 “Innovations - Champion TOP 30” distinction.
- 2011 “Most innovative SME – TOP 100” distinction.
- 2014 Renamed **relyon plasma GmbH**. The management team Dr. Stefan Nettesheim and Klaus Forster become 100% shareholders.
- Since 2018 member of the **TDK Group**
- May 2020 Launch of **piezobrush® PZ3**

reinhausen plasma

relyon plasma®

Area: 605 m²

Employees: 12

relyon plasma®

A TDK GROUP COMPANY

Area: 1287 m²

Employees: 25

Agenda of our product launch piezobrush® PZ3

piezobrush® PZ3

Surface treatment with plasma

Corinna Little, Application lab

piezobrush® PZ3 – Technology and features

Florian Hoppenthaler, Head of design and production and project manager piezobrush® PZ3

β

Application examples and live demonstration

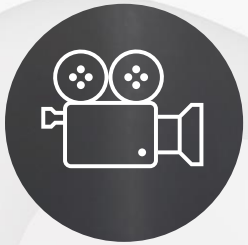
With first results from our beta testers

Q&A session

Together with you and our specialists

Organizational matters

piezobrush® PZ3



This webinar is being recorded and will be made availabe for you to share and rewatch

For the time being all audience members are muted

Feel free to ask questions at any time via the question field in the control panel

Questions will either be answered directly, after each agenda item or during the Q&A session

The new piezobrush® PZ3

piezobrush® PZ3

The world's smallest plasma handheld device with PDD® technology

Surface activation with plasma

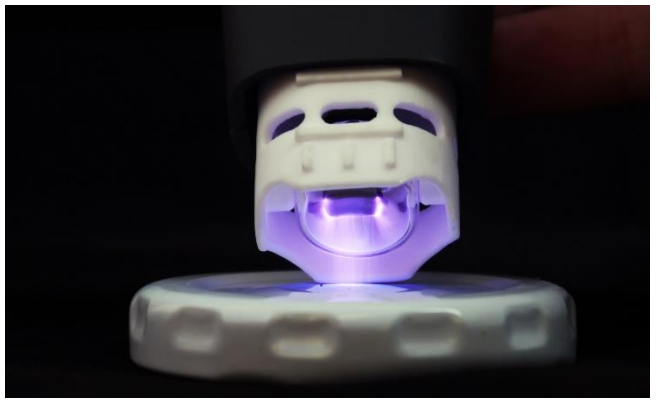
piezobrush® PZ3

Enhancement of surface energy with atmospheric plasma

Untreated surface:
Round droplet

- Low surface energy
- Insufficient wetting
- Weak bonding

Treatment with atmospheric plasma



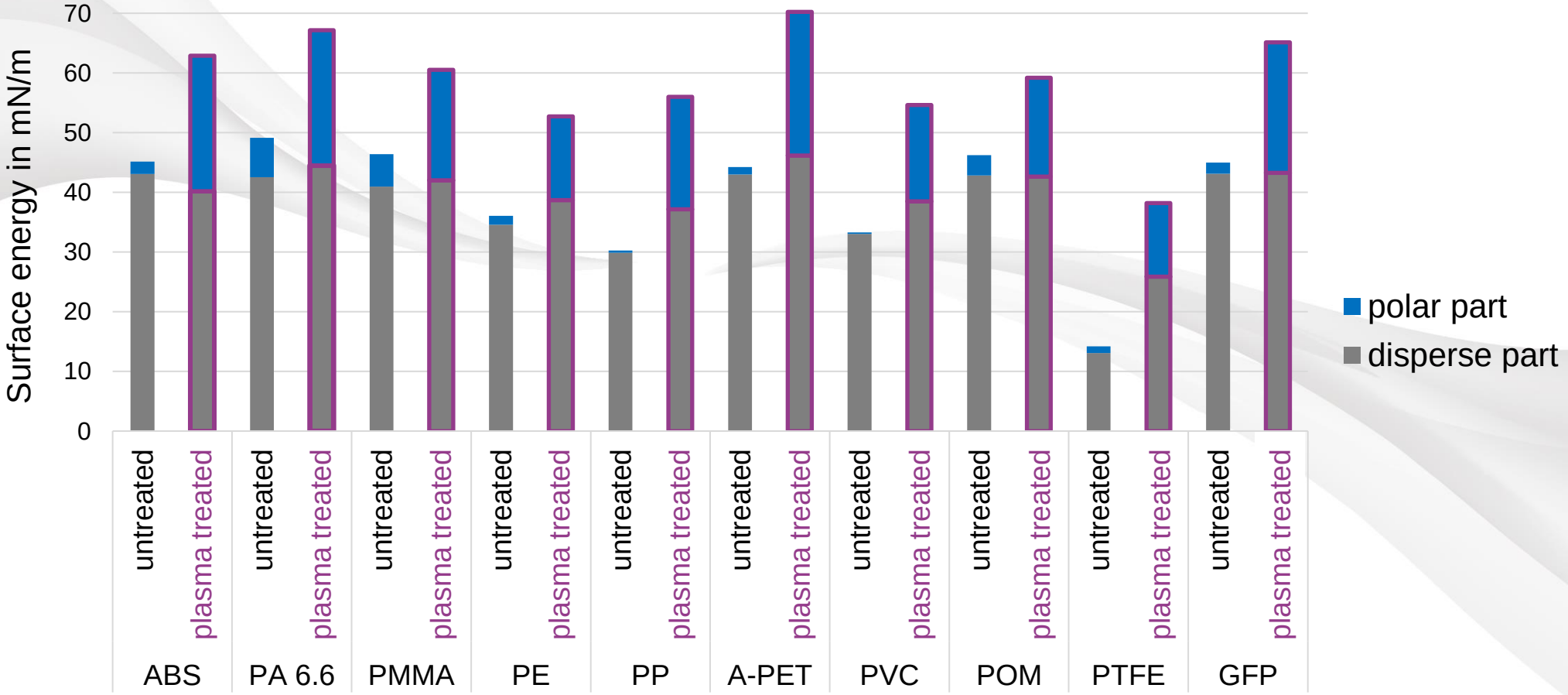
After plasma treatment:
Flat droplet

- High surface energy
- Increased wetting
- Strong bonding

Improved wettability by plasma treatment

piezobrush® PZ3

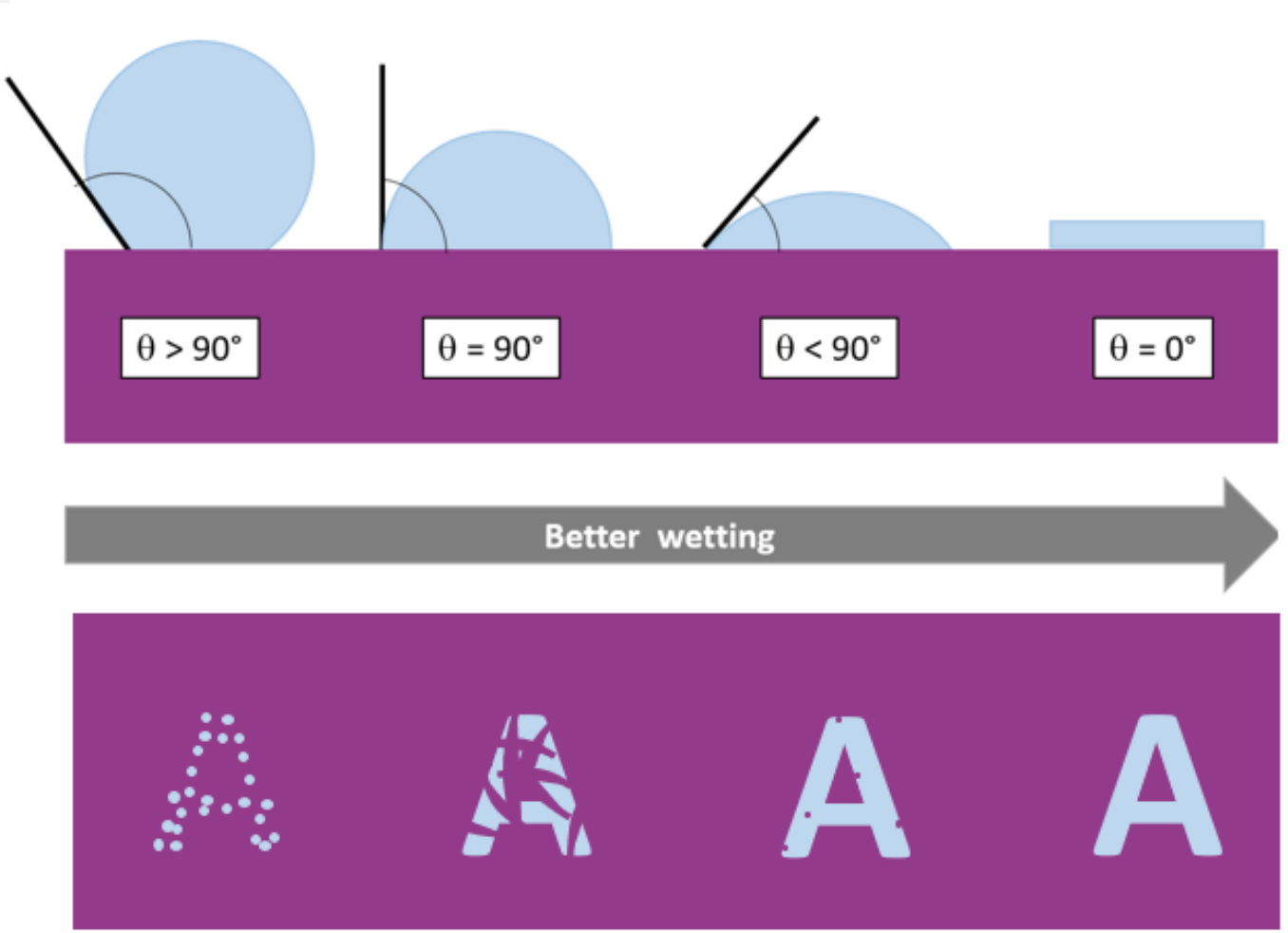
Surface energy – Quantifying the effects of the plasma treatment



Plasma treatment prior to printing

piezobrush® PZ3

Effect of surface wettability on printing results



Plasma treatment prior to printing

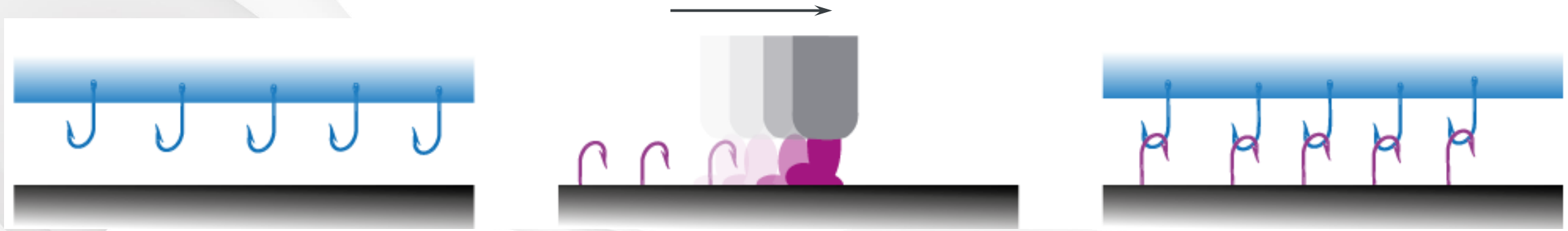
piezobrush® PZ3

Application example: Inkjet printing on PTFE (Teflon)

Surface activation of polymers

piezobrush® PZ3

Enhancing adhesion with atmospheric plasma



Untreated surface:
No sites available for chemical bonding

- Low surface energy
- Insufficient wetting
- Weak bonding

- Generation of anchor groups
- Activation of surface
- Hardly any thermal input

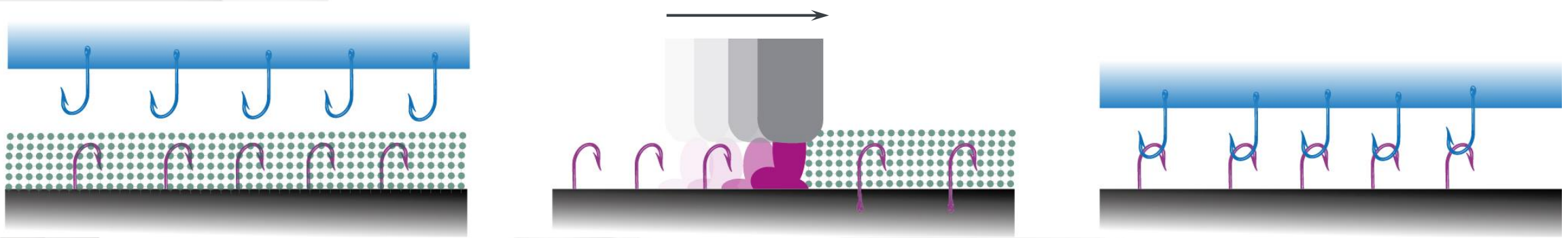
After plasma treatment:
Corresponding bonding sites generated

- High surface energy
- Increased wetting
- Strong bonding

Fine cleaning of surfaces

piezobrush® PZ3

Enhancing adhesion with atmospheric plasma



Untreated surface:
Bonding sites inactivated by contaminants

- Low surface energy
- Insufficient wetting
- Weak bonding

- Fine cleaning of organic contaminants
- Reactivation of anchor groups

After plasma treatment:
Contaminants are removed making bonding sites available

- High surface energy
- Increased wetting
- Strong bonding

Recap – Surface treatment with plasma

piezobrush® PZ3

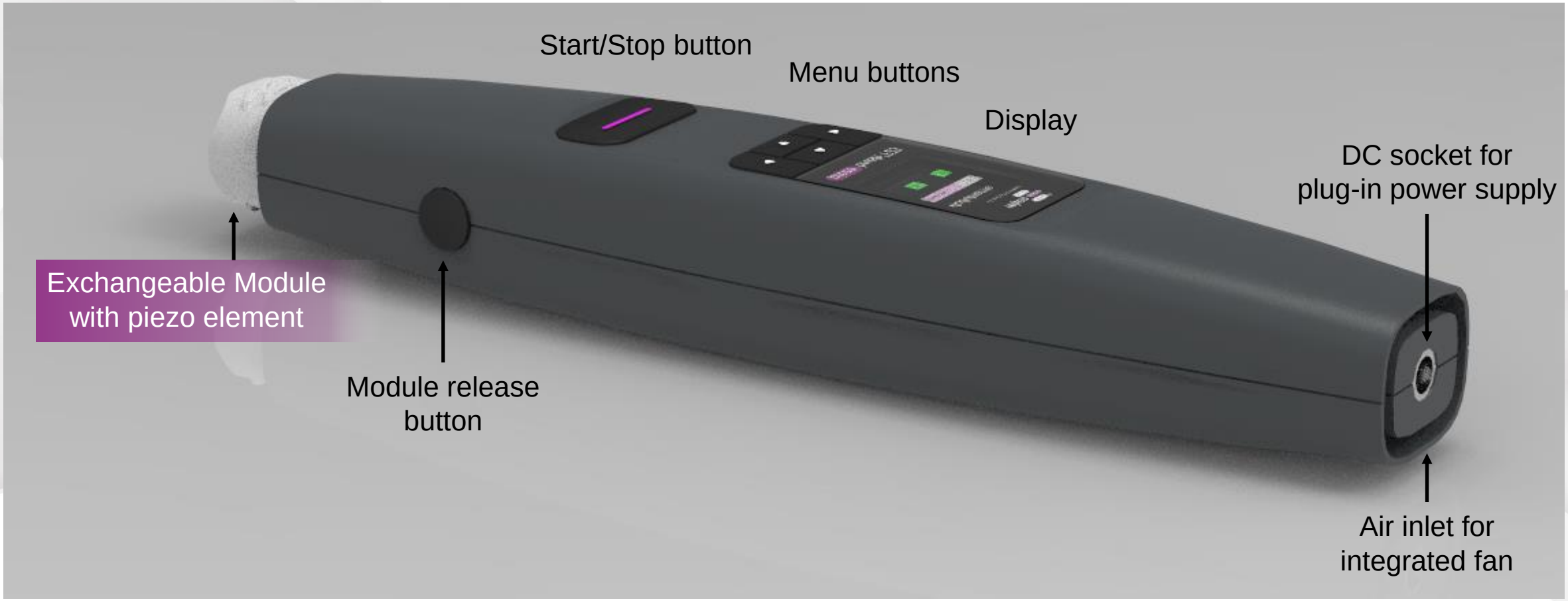
- The **wettability** of a surface is a cruicial indicator for the quality of adhesive follow-up processes
- **Contact angle measurements** or **test inks** are means of determining the **surface energy**
- During processing **surfaces are contaminated** with coolants, lubricants, release agents, etc.
- Only a couple of monolayers of **contaminants can decrease the quality of adhesive processes**
- **Cold plasma** is used for **fine cleaning** by oxidising thin layers of organic contaminants
- Some materials, like most **plastics**, show **low surface energy** even if they are clean
- **Cold plasma activates** hydrophobic plastic surfaces by **generating polar anchor groups**

Cold plasma increases the wettabilty of surfaces to optimise adhesive processes such as gluing, printing, coating, varnishing, etc.

The new piezobrush® PZ3 from head to toe

piezobrush® PZ3

Device overview and details

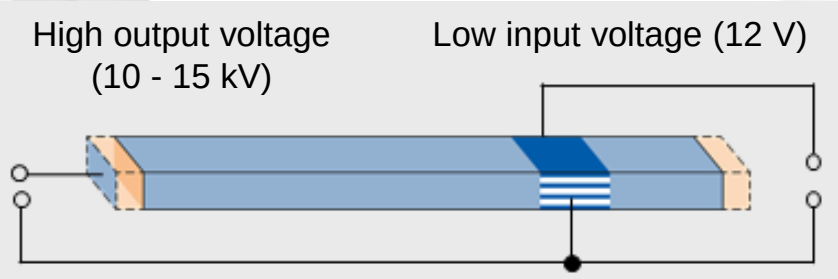


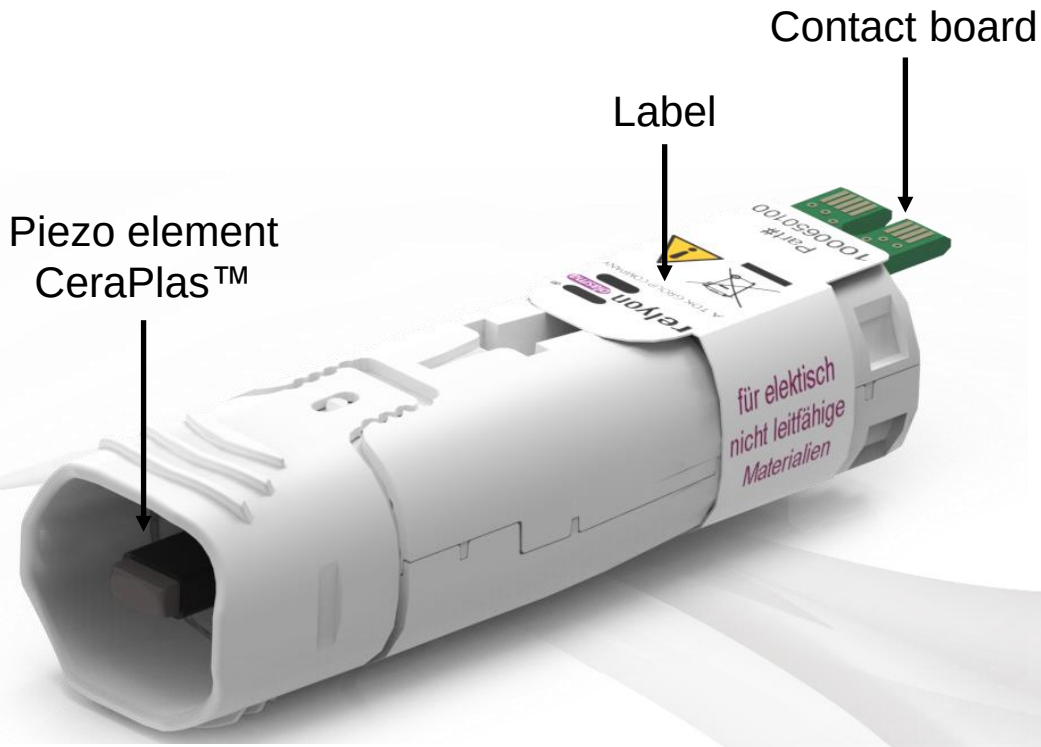
How is plasma generated in the piezobrush® PZ3?

piezobrush® PZ3

At the heart of the modules: CeraPlas™ by TDK

CeraPlas™ – compact plasma generator:
A single piezoelectric component generates high voltage in minimum space.





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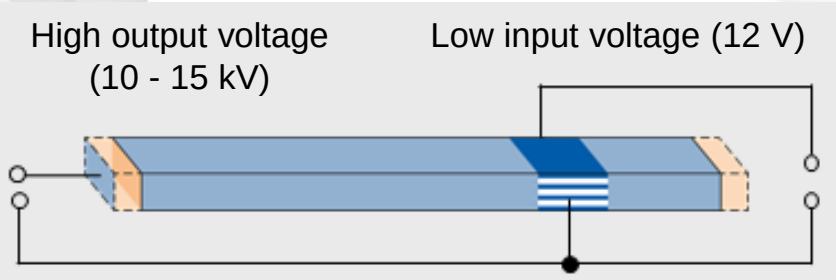
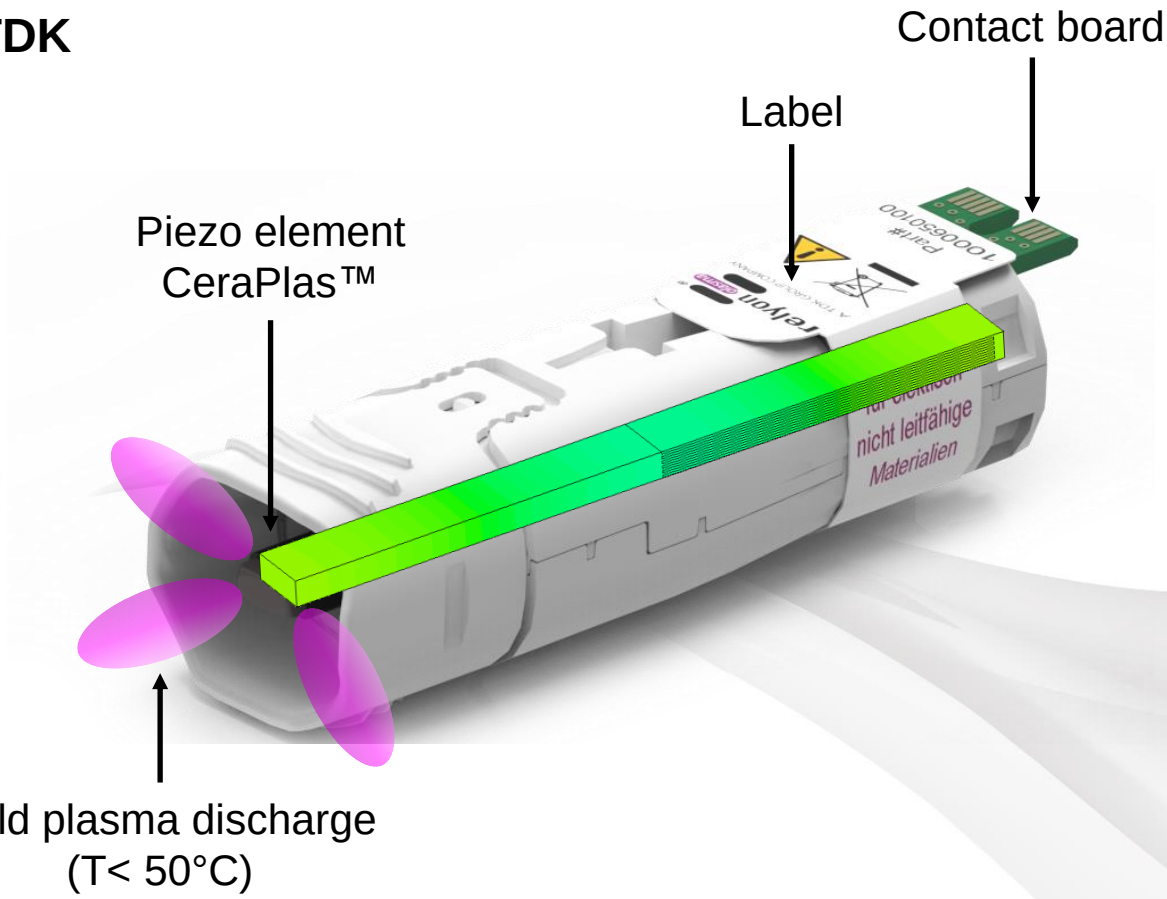




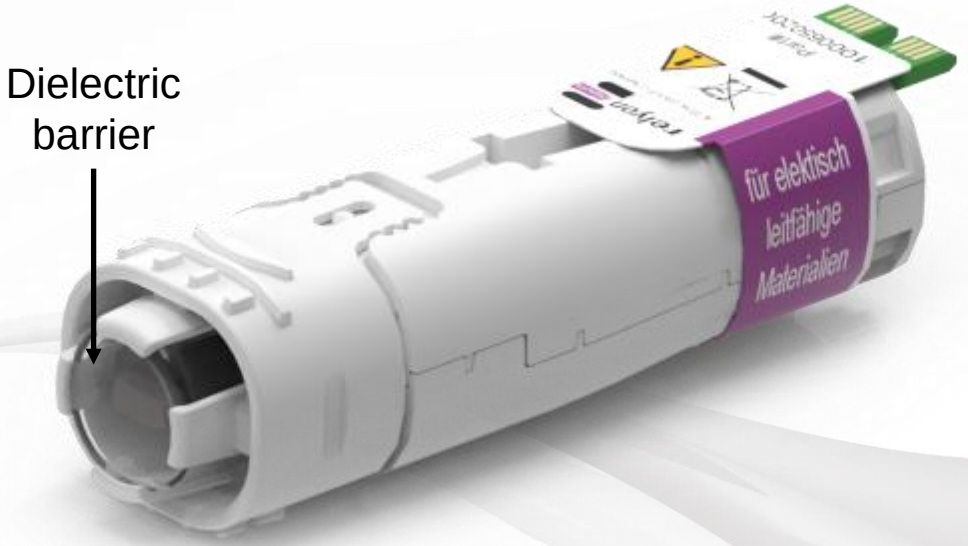
Choosing the right module

piezobrush® PZ3

Module “Standard”
for the treatment of **non-conductive** materials

Material examples:
- Plastics (PTFE, PE, PA, PP, etc.)
- Glass
- Ceramics
- Paper, natural fibres
- …

Module “Nearfield”
for the treatment of **conductive** materials

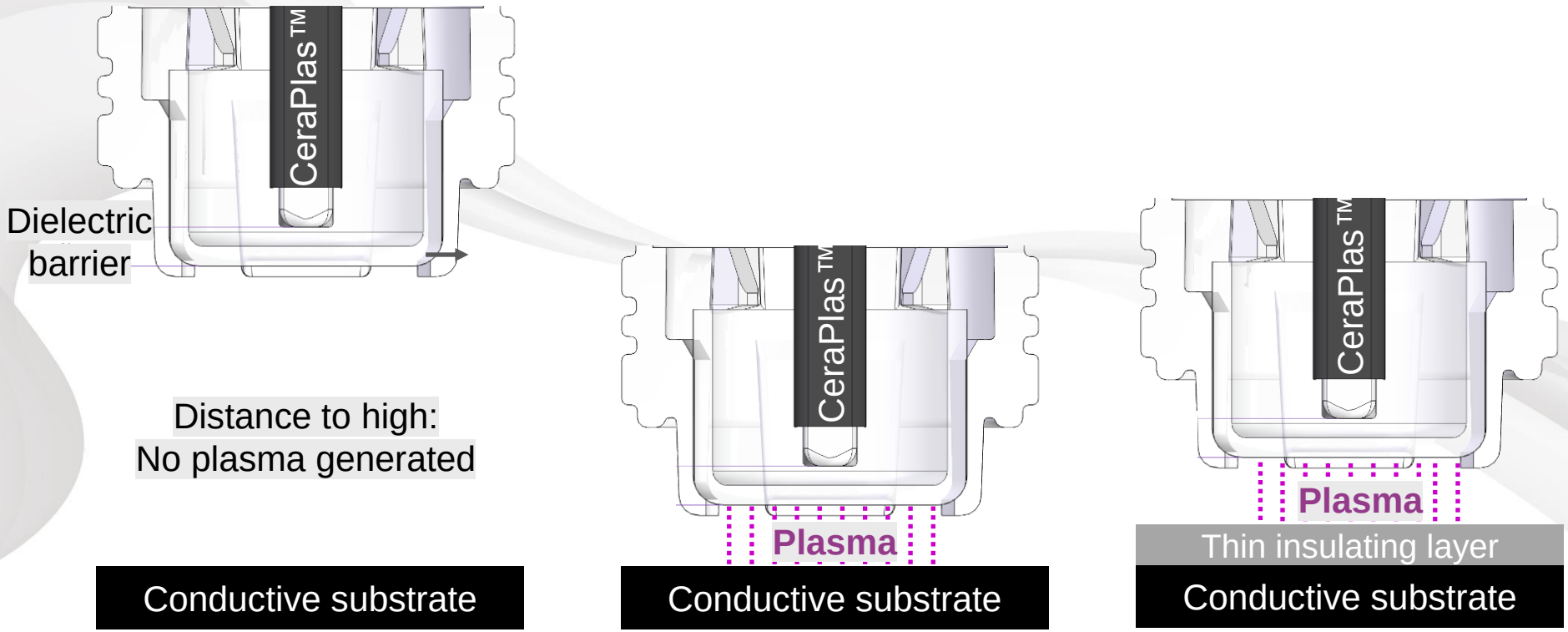


Material examples:
- Metals (steel, aluminium, alloys, etc.)
- Carbon fibre composites
- Doped semiconductors
- Wood
- …

The new piezobrush® PZ3 – simple and precise

piezobrush® PZ3

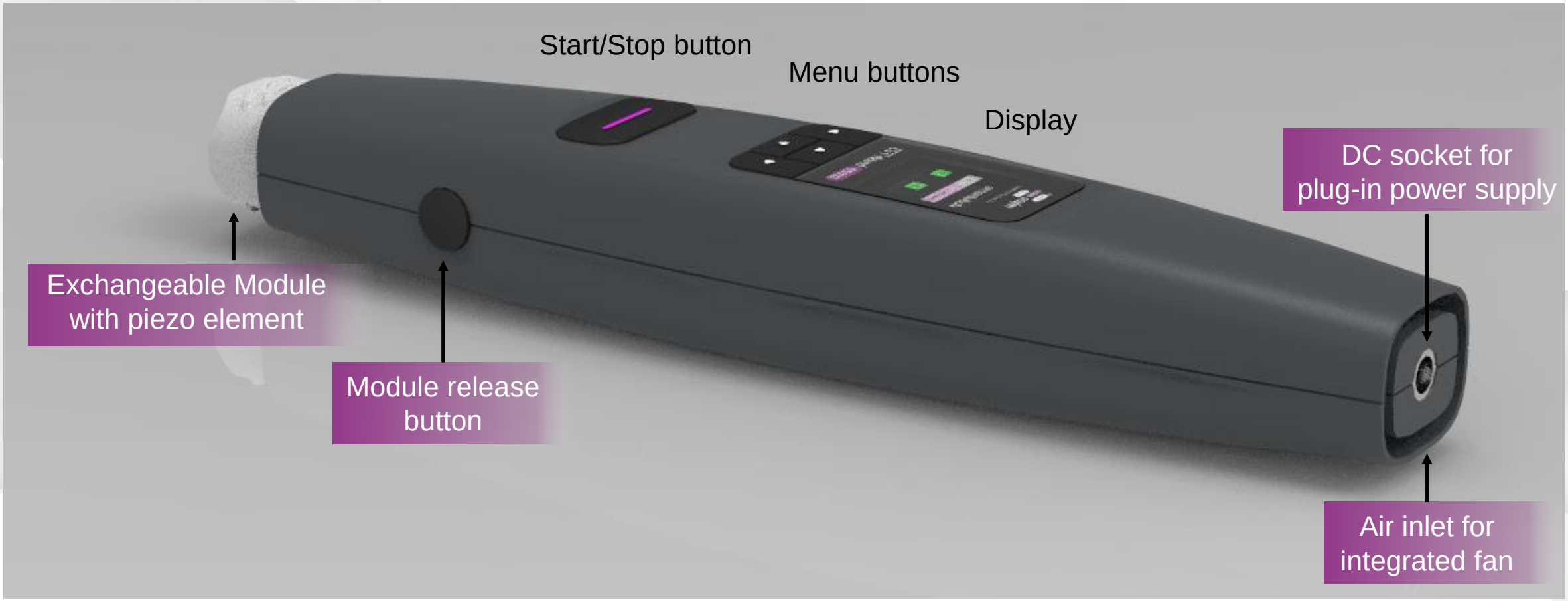
Plasma treatment – working with the Module “Nearfield”



The new piezobrush® PZ3 – plug-and-play all the way

piezobrush® PZ3

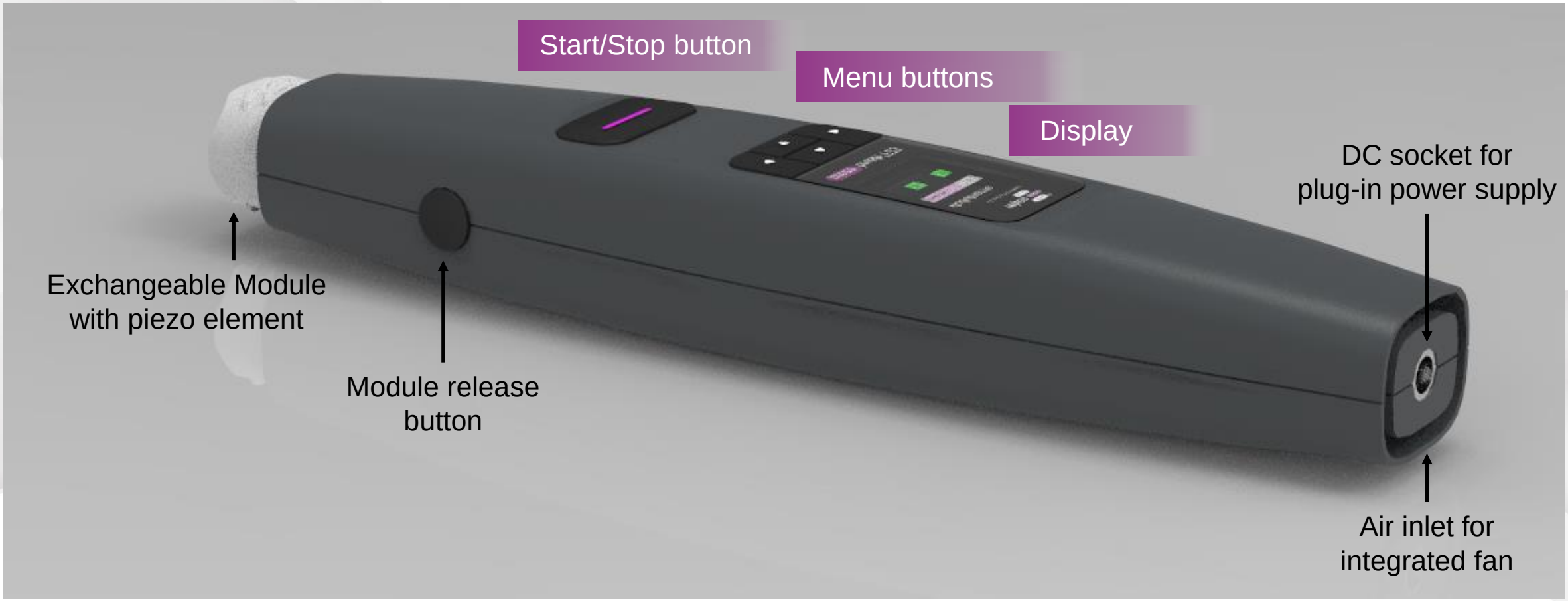
Setting up the piezobrush® PZ3 – easy and intuitive



The new piezobrush® PZ3 – ready to go

piezobrush® PZ3

Starting the plasma treatment – features of the piezobrush® PZ3



Process control with the piezobrush® PZ3

Display and features – Full overview on the home screen

Module currently detected in the device

Process tool mode selected and current **time value**

Current **power setting** in % and **status** of P lasma, F an and T emperature

For example:
Module “Standard“

Possible modes:
Stopwatch, Countdown, Metronome

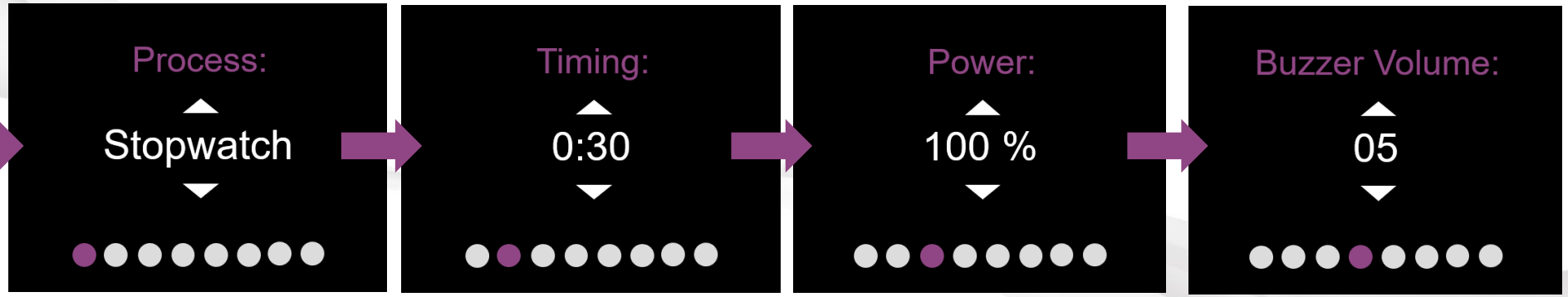
Status color code:

Not active
OK
Critical
Error

Process control with the piezobrush® PZ3

piezobrush® PZ3

Menu items for comfortable fine tuning of your plasma treatment

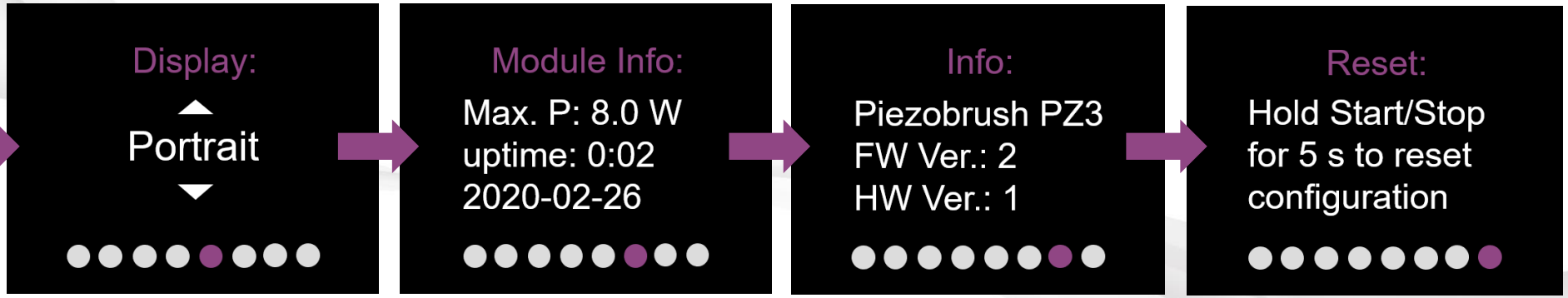


Arrow keys left/right for **navigation** through menu items

Arrow keys up/down for **setting** within the menu items

Process control with the piezobrush® PZ3

Menu items for comfortable fine tuning of your plasma treatment

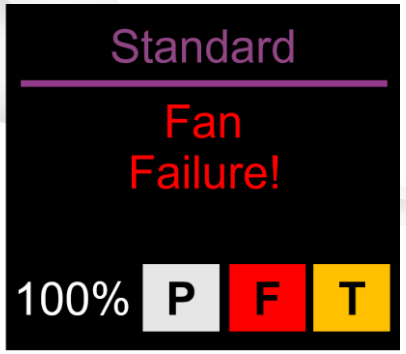


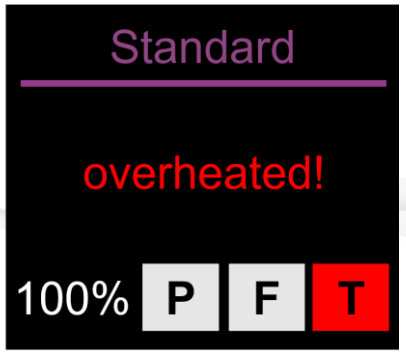
Arrow keys left/right for **navigation** through menu items

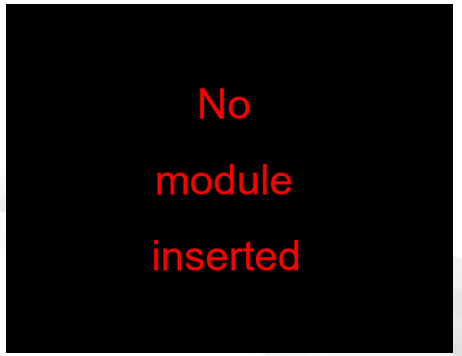
Arrow keys up/down for **setting** within the menu items

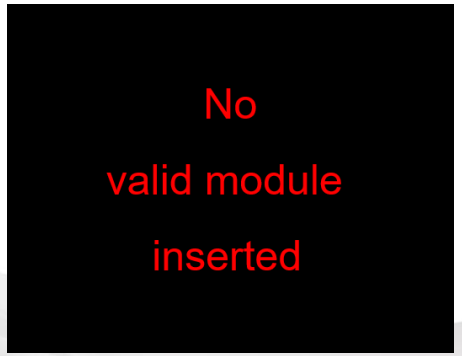
Error Codes of the piezobrush® PZ3

Due to the improved electronics of the piezobrush® PZ3 you get detailed error codes





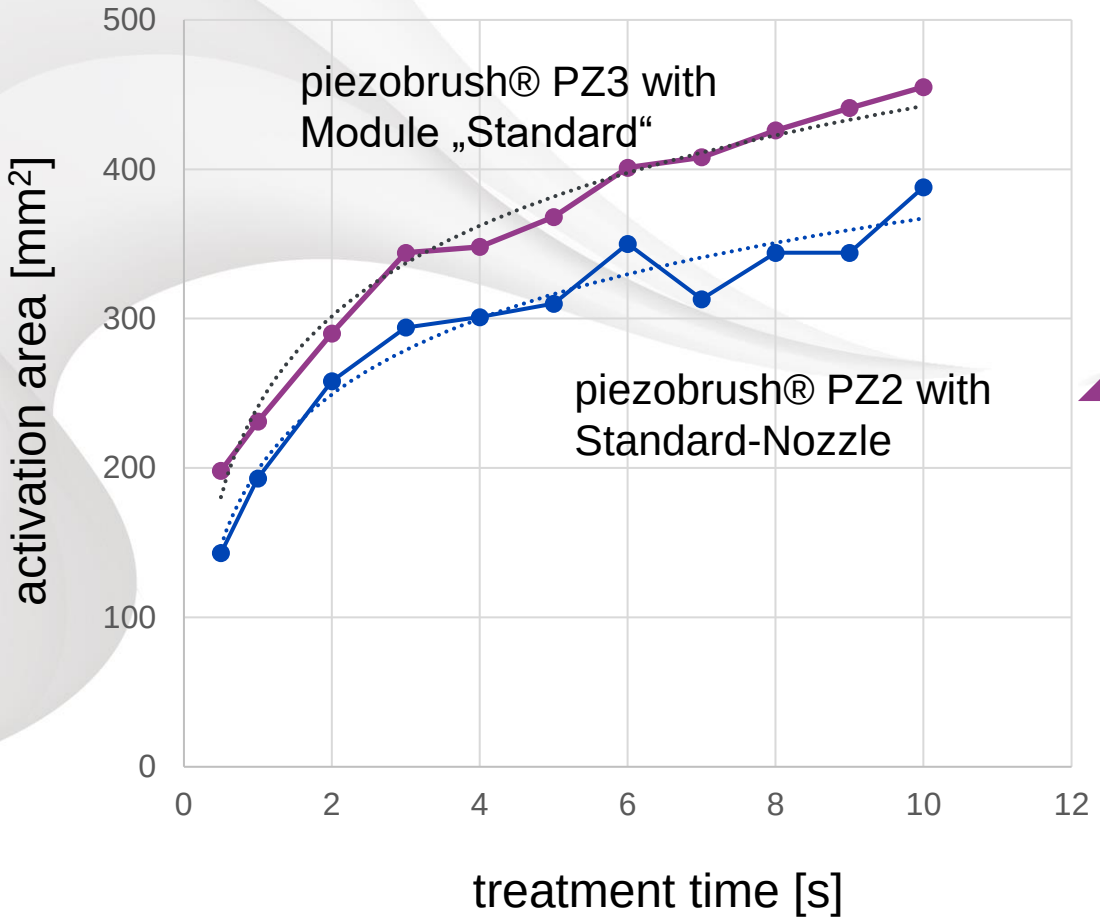




Comparison between piezobrush® PZ2 and piezobrush® PZ3
Activation performance Module “Standard”

piezobrush® PZ3

Substrate: LDPE Plate
Surface energy: 58 mN/m Distance: 4,5 mm

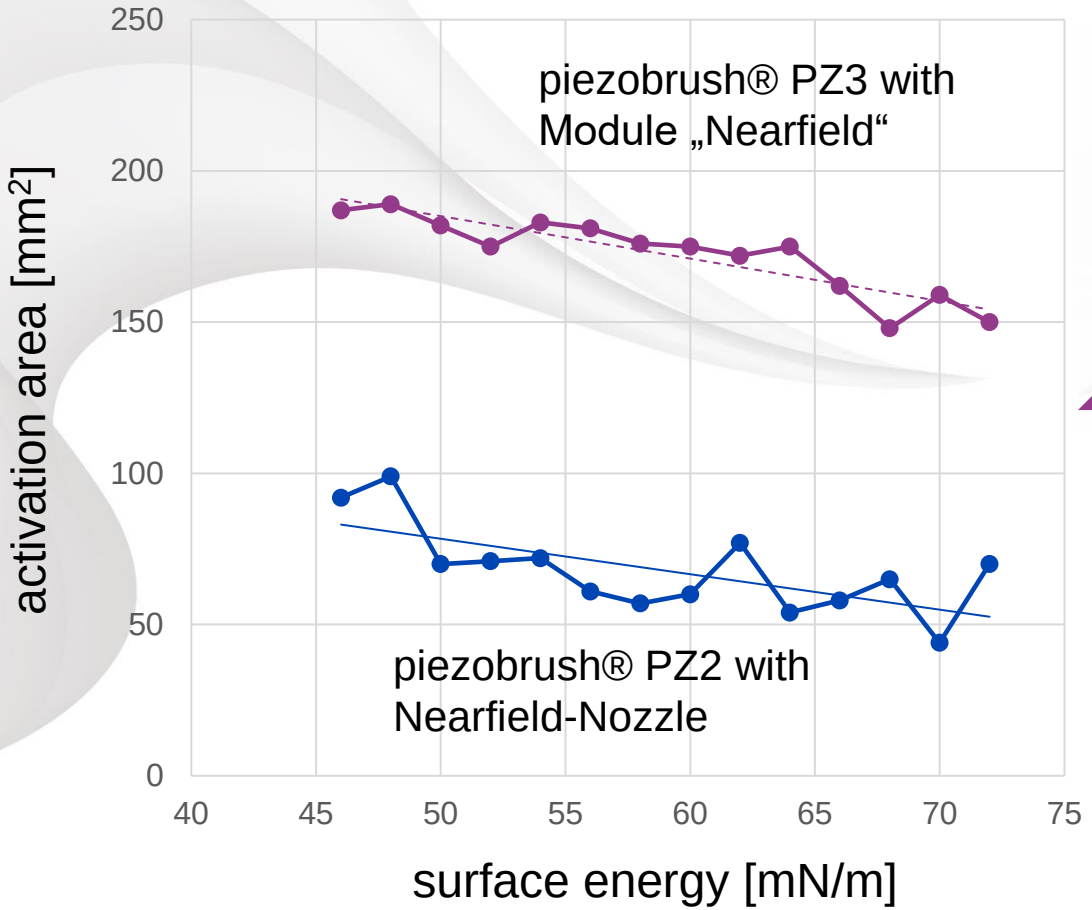


Increase of activation performance of about 20 % from piezobrush® PZ2 to piezobrush® PZ3

Comparison between piezobrush® PZ2 and piezobrush® PZ3
Activation performance Module “Nearfield”

piezobrush® PZ3

Substrate: ABS plate placed on Aluminum-plate
Treatment time: 10 s Distance: 1 mm



Increase of activation performance of about 100% from piezobrush® PZ2 to piezobrush® PZ3

Comparison between piezobrush® PZ2 and piezobrush® PZ3

piezobrush® PZ3

110-240 V / 50-60 Hz 15 V DC	**Electrical connection**	110-240 V / 50-60 Hz 24 V DC
max. 30 W	**Power consumption**	max. 15 W
170 g	**Weight**	110 g
57 dB	**Sound level**	45 dB
< 50 °C	**Plasma temperature**	< 50 °C
4 cm²/s	**Treatment speed**	5 cm²/s
2 - 10 mm	**Typical treatment distance**	2 - 10 mm
20 mm	**Max. treatment width**	29 mm
No process control available	**Process control**	Power adjustment; error detection; 3 different types of process control with visual and acoustic feedback
2.750 EUR	**RRP Device + Standard-m.**	1.920 EUR
2.900 EUR	**RRP Device + Stand. + Nearfield**	2.400 EUR

The new piezobrush® PZ3

piezobrush® PZ3

Scope of delivery and key data

Scope of delivery shown for piezobrush®PZ3 Professional Set

Electrical connection	110-240 V / 50-60 Hz
Power consumption	18 W
Design	Handheld unit with plug-in power supply, integrated fan
Plasma temperature	<50 °C
Weight	110 g
Treatment speed	5 cm^2/s
Treatment distance	2 - 10 mm
Treatment width	5 - 29 mm

In which area would you like to see improvements?

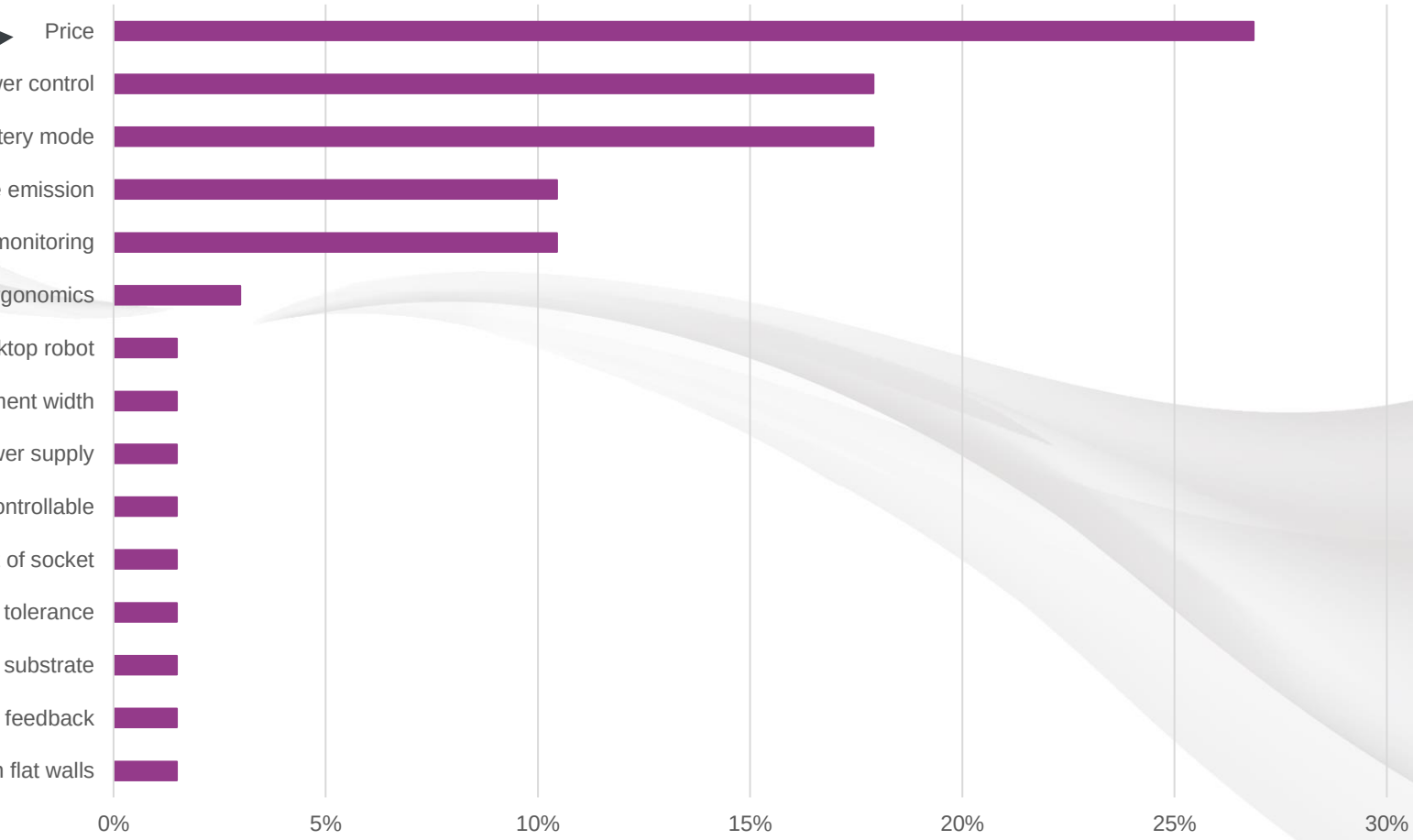
piezobrush® PZ3

Our development is driven by our customer‘s wishes

piezobrush® PZ3
(availiable 06/2020)

up to 8 modules planned
for piezobrush® PZ3
(availiable gradually until
Q1/2021)

piezobrush® PZ3-i
(availiable ~Q1/2021)



The new piezobrush® PZ3

piezobrush® PZ3

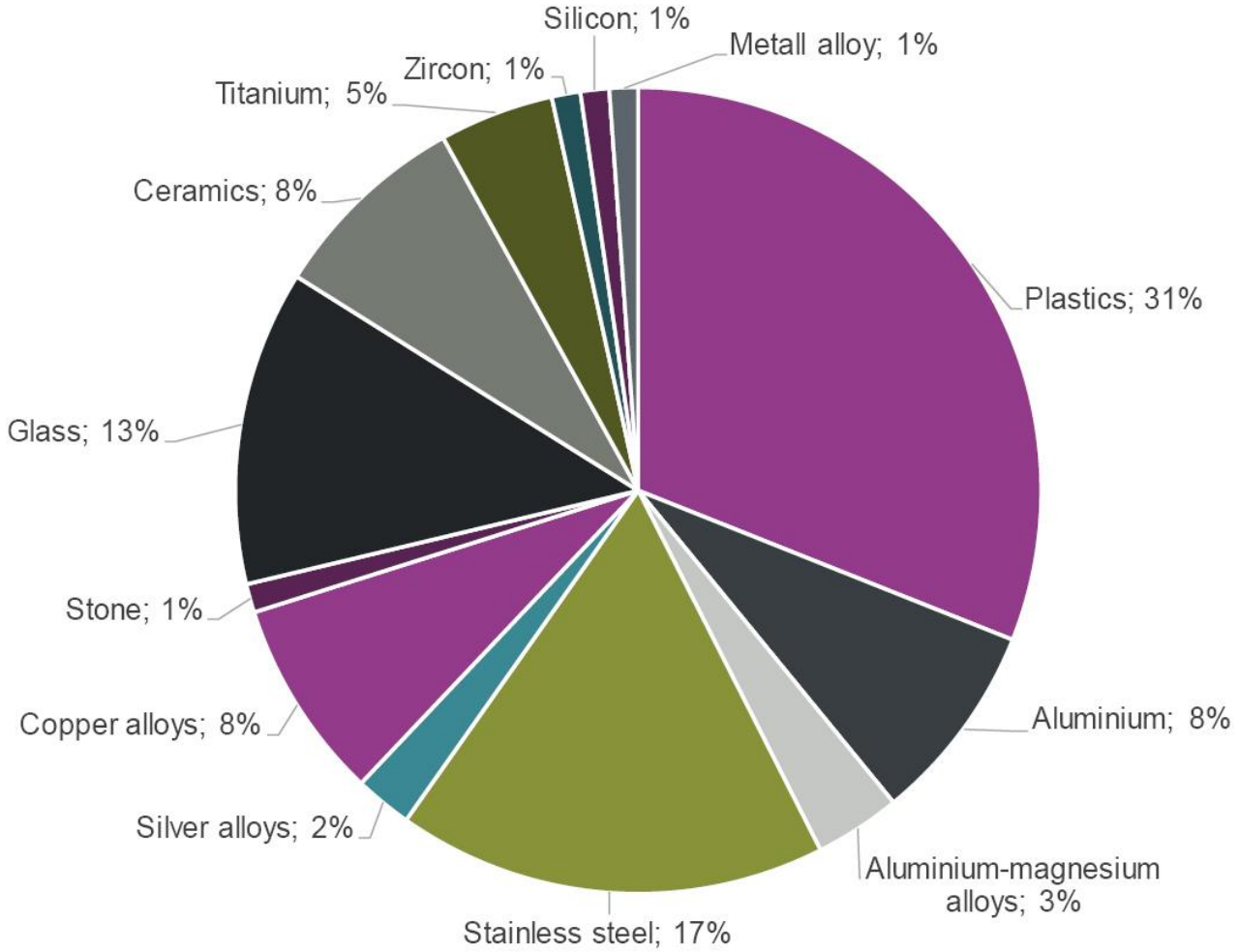
The world's smallest plasma handheld device with PDD® technology

- → Interchangeable modules
- → Improved HMI
- → Improved process control
- → Improved performance
- → Improved service
- → Improved quality
- → Improved price

The new piezobrush® PZ3 – an allrounder

piezobrush® PZ3

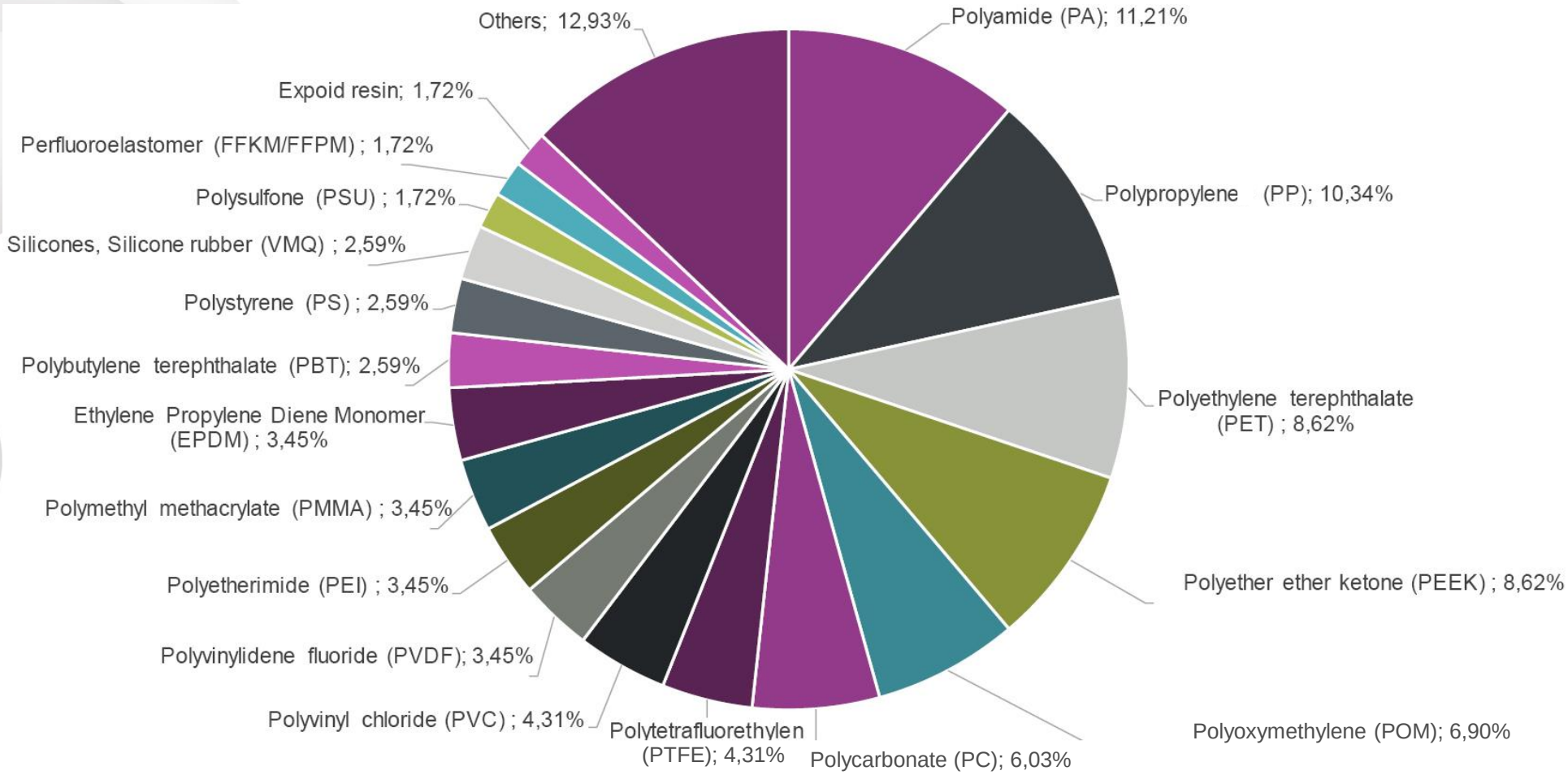
Materials that are treated with our cold plasma technology



The new piezobrush® PZ3 – an allrounder

piezobrush® PZ3

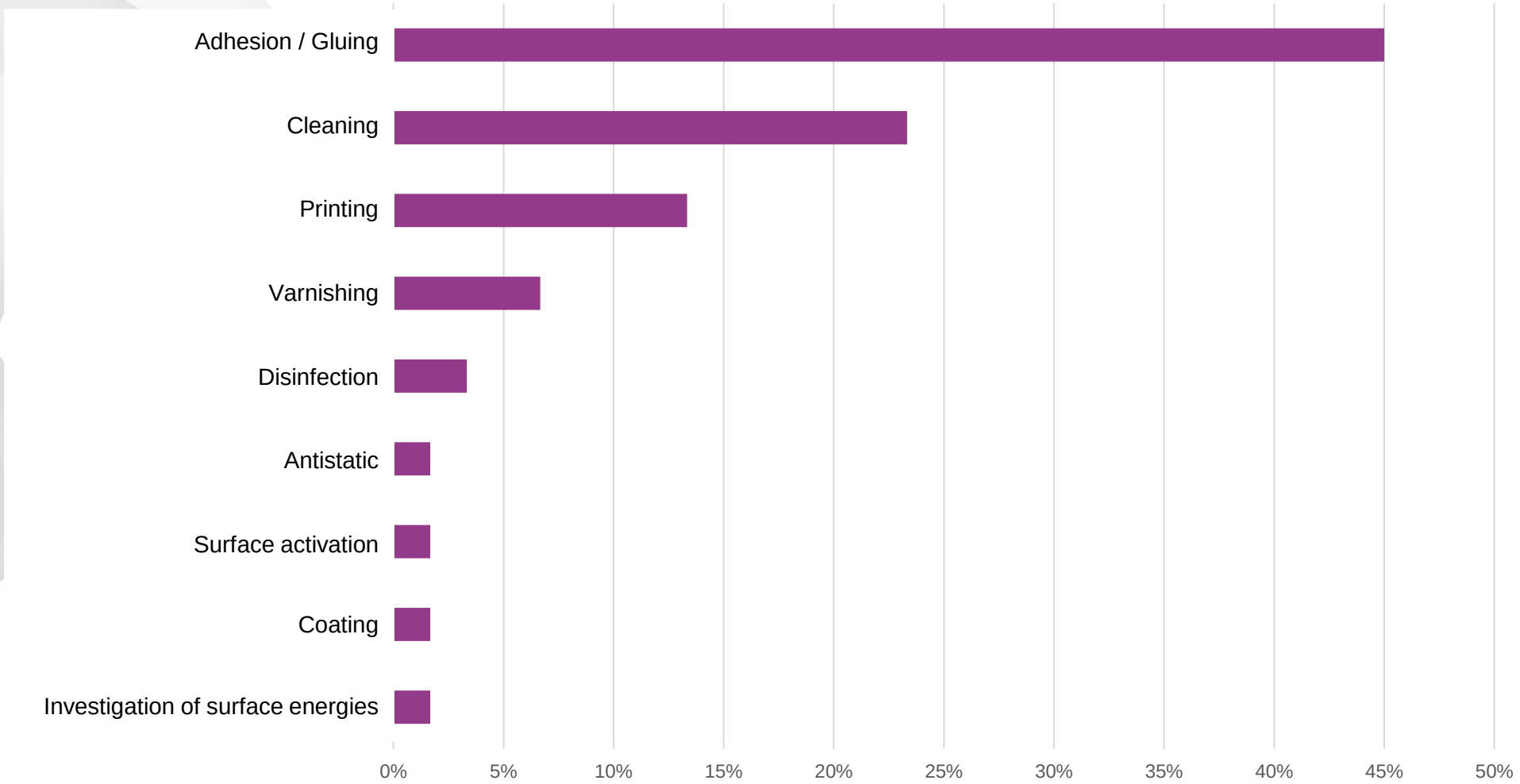
Plastics that are treated with our cold plasma technology



The new piezobrush® PZ3 – an allrounder

piezobrush® PZ3

Processes improved with our cold plasma technology



Application example: Improved bonding in additive manufacturing

piezobrush® PZ3

Structural bonding of SLS printed PA parts

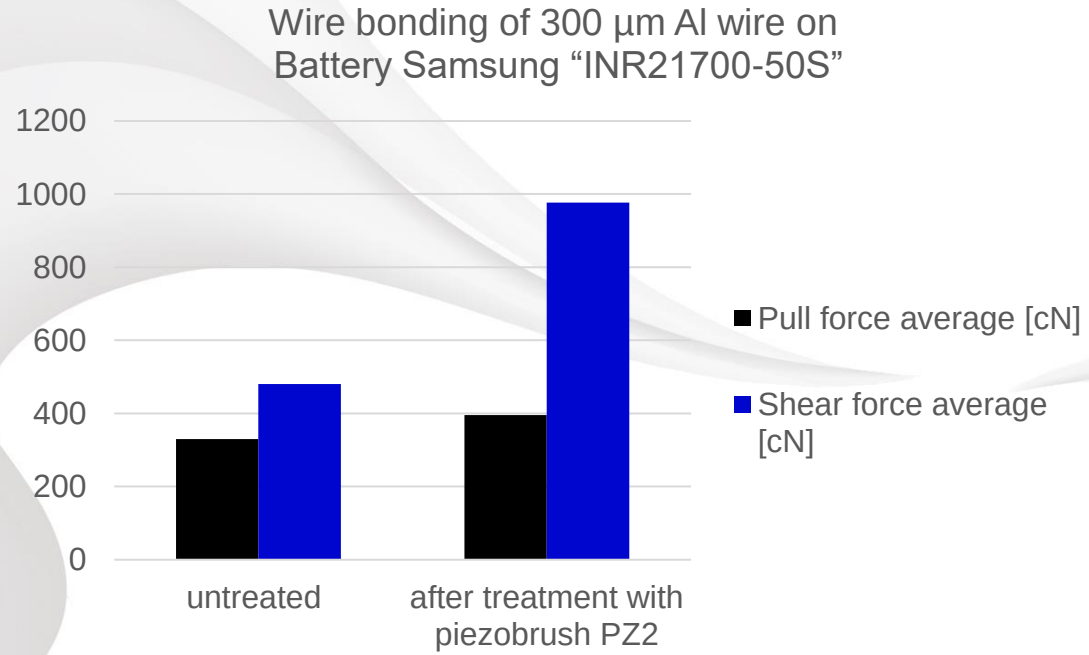
- In 3D printing, large parts are often manufactured as individual parts made of PA 12 and subsequently bonded - however, often with considerable adhesion problems.
- By means of a plasma pre-treatment, up to three times the strength of the adhesive joints is achieved without the use of environmentally harmful chemical primers.

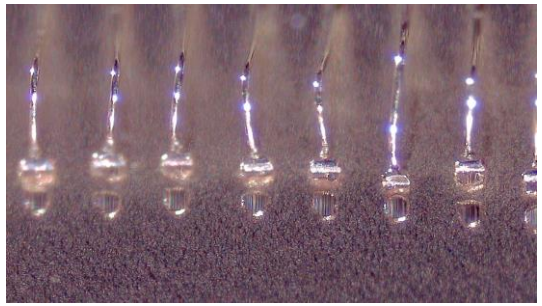
Creabis realized conceptions

Application example: Wire bonding

piezobrush® PZ3

Increased bonding strength on contact surfaces





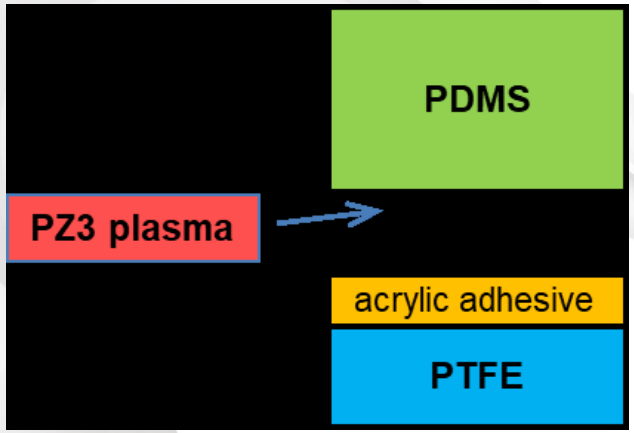
Axend
Electronics Assembly Process Solutions

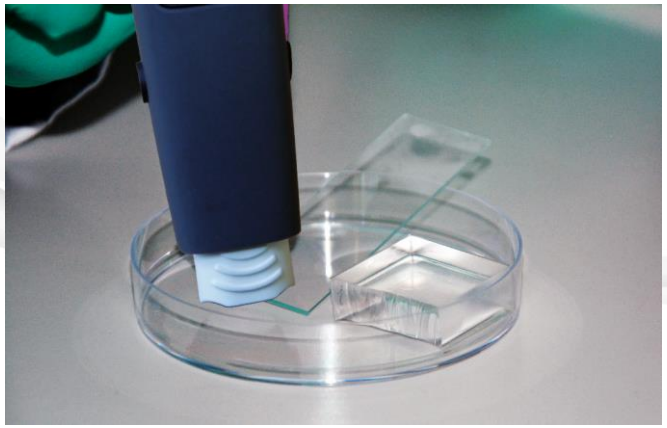
tpt

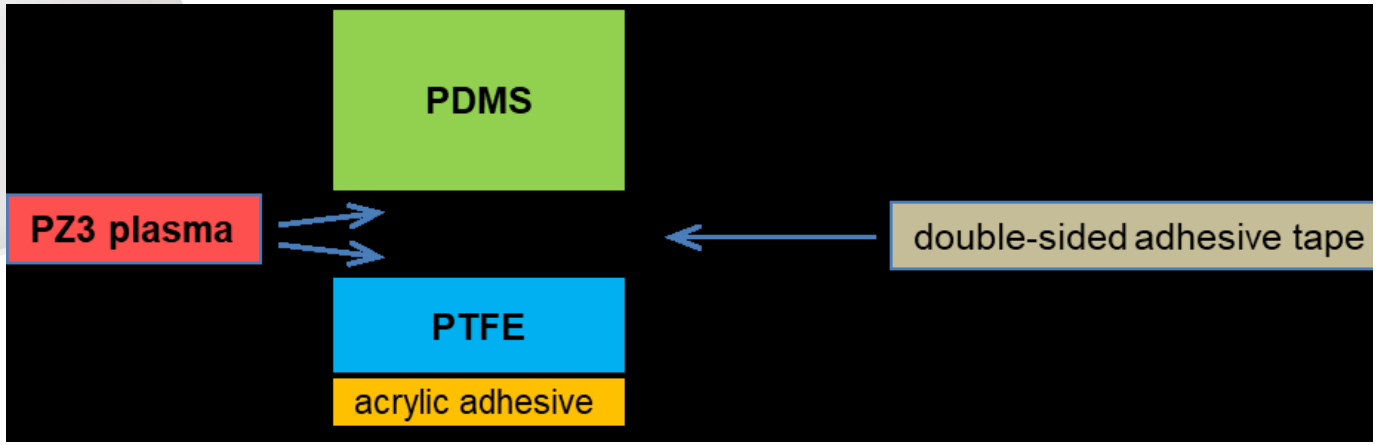
Beta test: Karlsruhe Institute of Technology

piezobrush® PZ3

Fabrication of Elastic and Chemically Inert Gaskets Made of PTFE and PDMS Films by A. Voigt & K. Länge







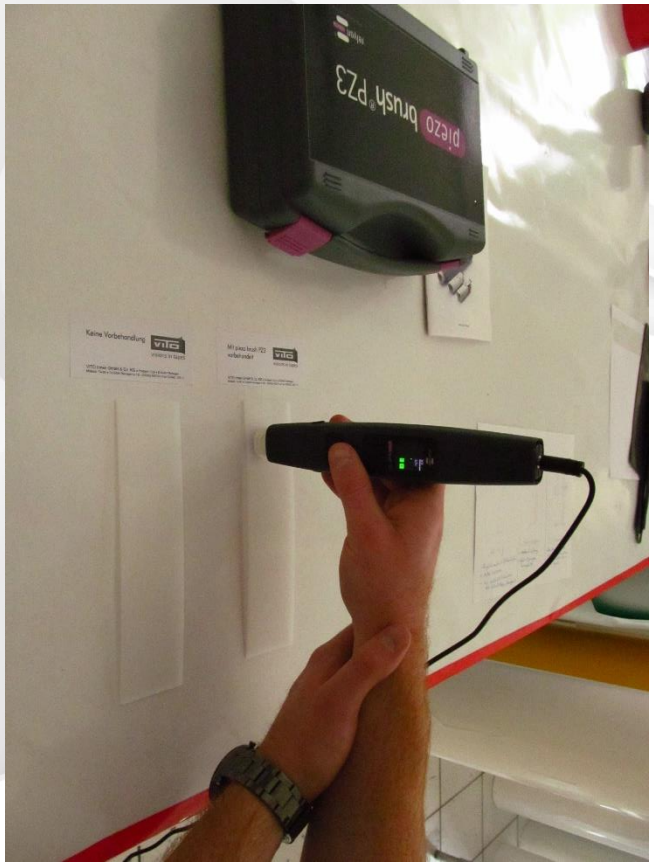
"The piezobrush® PZ3 device led to excellent results and is still easy and effortless to handle. PZ3 plasma treatment of low energy surfaces, such as PDMS and PTFE, allowed subsequent bonding with simple double-sided adhesive tape with only little effort; and the resulting gaskets met the requirements regarding elasticity and chemical inertness."

IMT KIT
Karlsruher Institut für Technologie

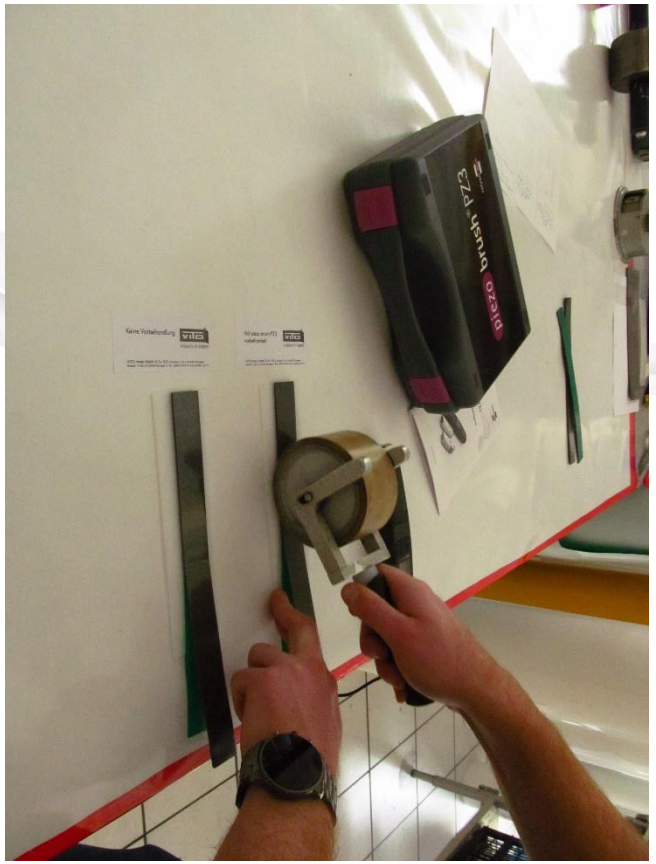
Beta test: VITO Irmen Gmbh & Co. KG

piezobrush® PZ3

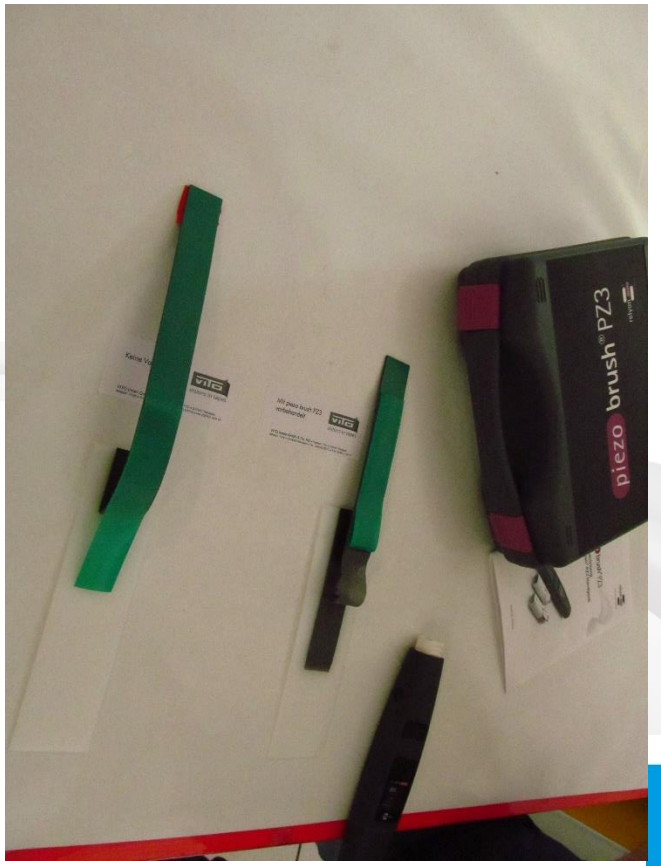
Adhesion improvement on HDPE of pressure sensitive tape (VITOMOUNT SSPR30) by F. Malek



Surface treatment with piezobrush® PZ3



Application of pressure sensitive tape



Cohesive failure of plasma treated sample

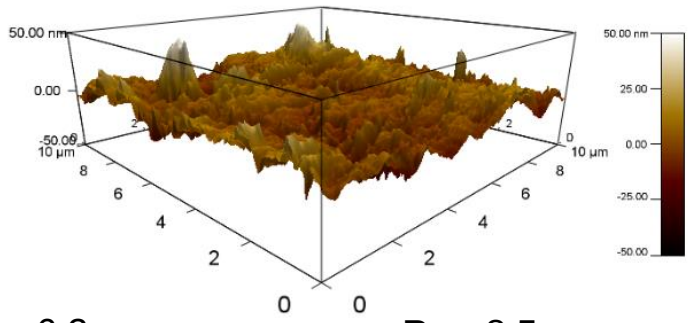
vito
visions in tapes

Beta test: INNOVENT e. V. Technologieentwicklung Jena

piezobrush® PZ3

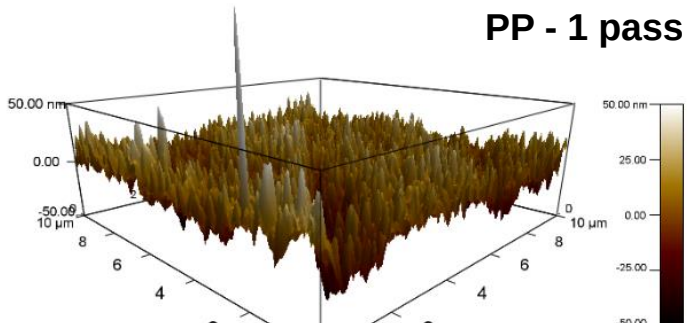
Characterization and bonding of plasma modified Polypropylene (PP) by O. Beier & A. Pfuch

PP Ref

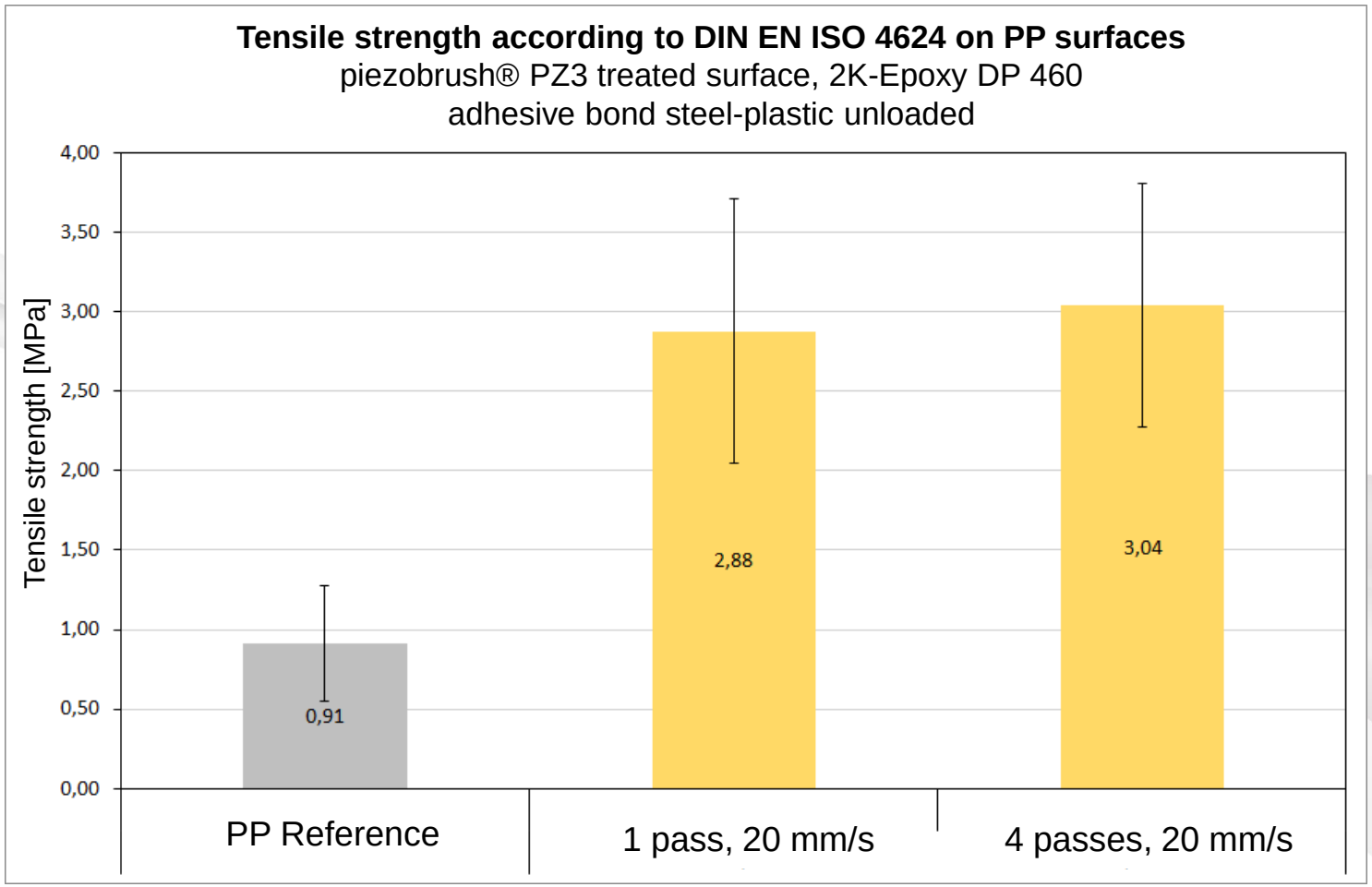


R_a = 6,2 nm R_q = 8,5 nm

PP - 1 pass



R_a = 8,8 nm R_q = 11,3 nm



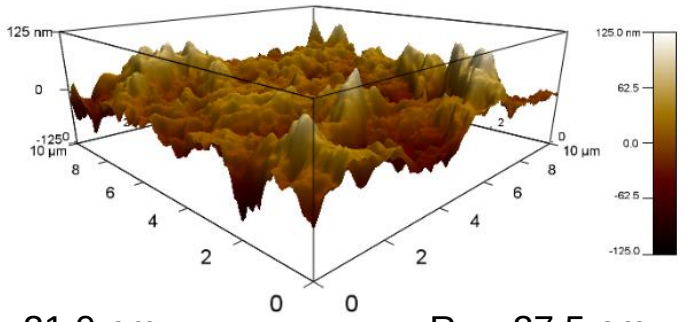
INNOVENT

Beta test: INNOVENT e. V. Technologieentwicklung Jena

piezobrush® PZ3

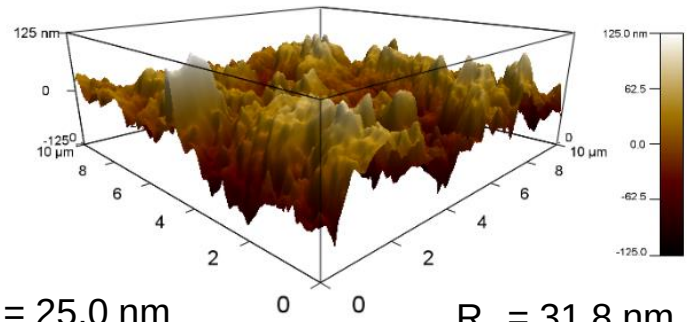
Characterization and bonding of plasma modified Polytetrafluorethylene (PTFE) by O. Beier & A. Pfuch

PTFE Ref

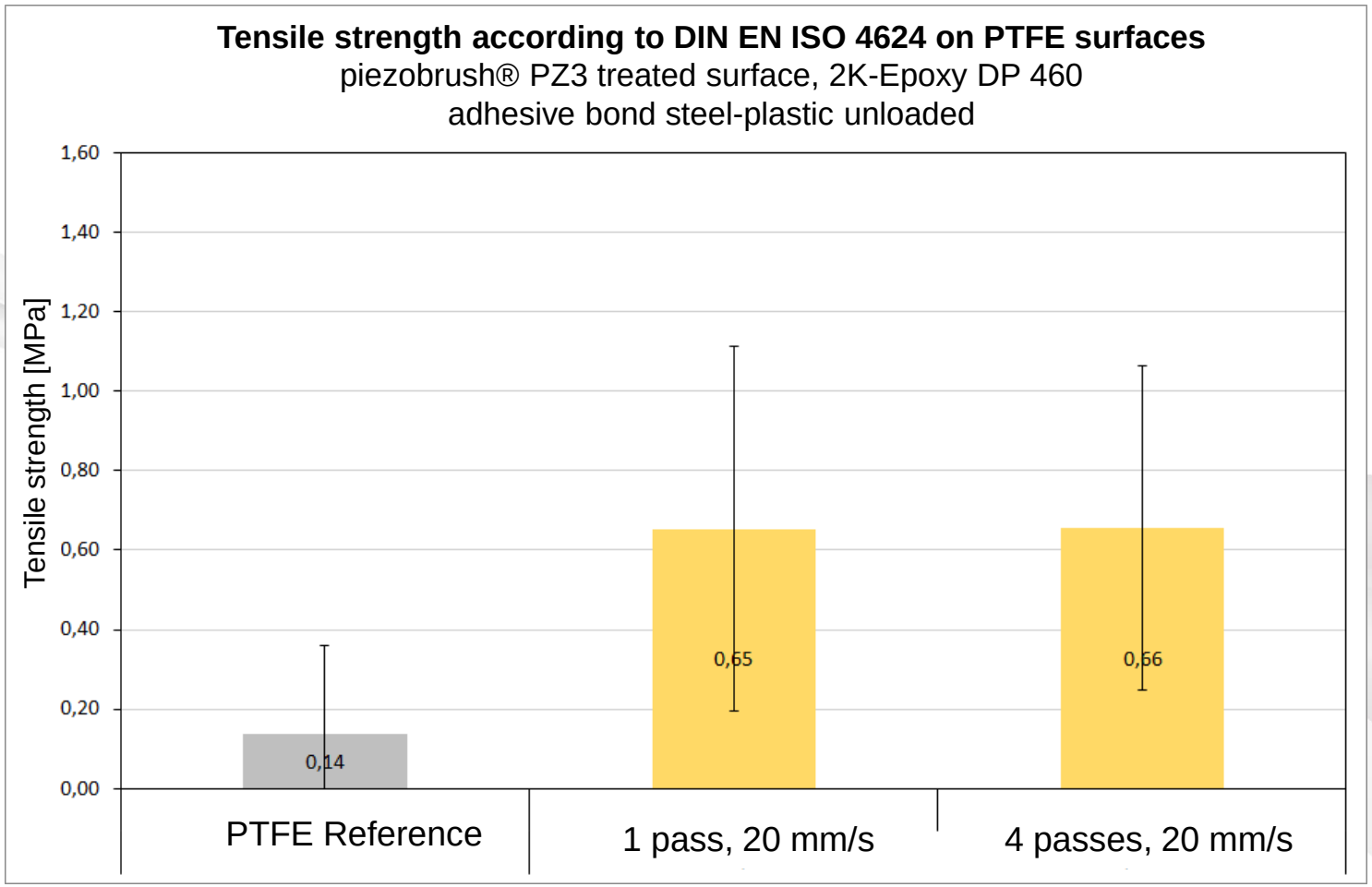


R_a = 21,0 nm R_q = 27,5 nm

PTFE - 1 pass



R_a = 25,0 nm R_q = 31,8 nm

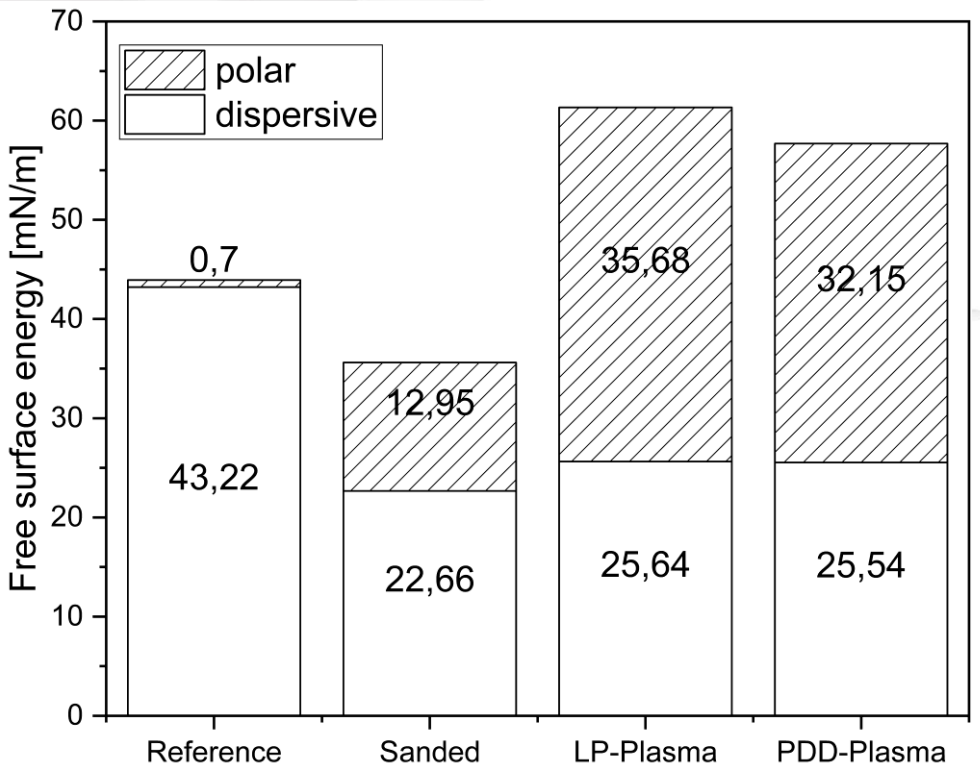


INNOVENT

Beta test: University Osnabrück

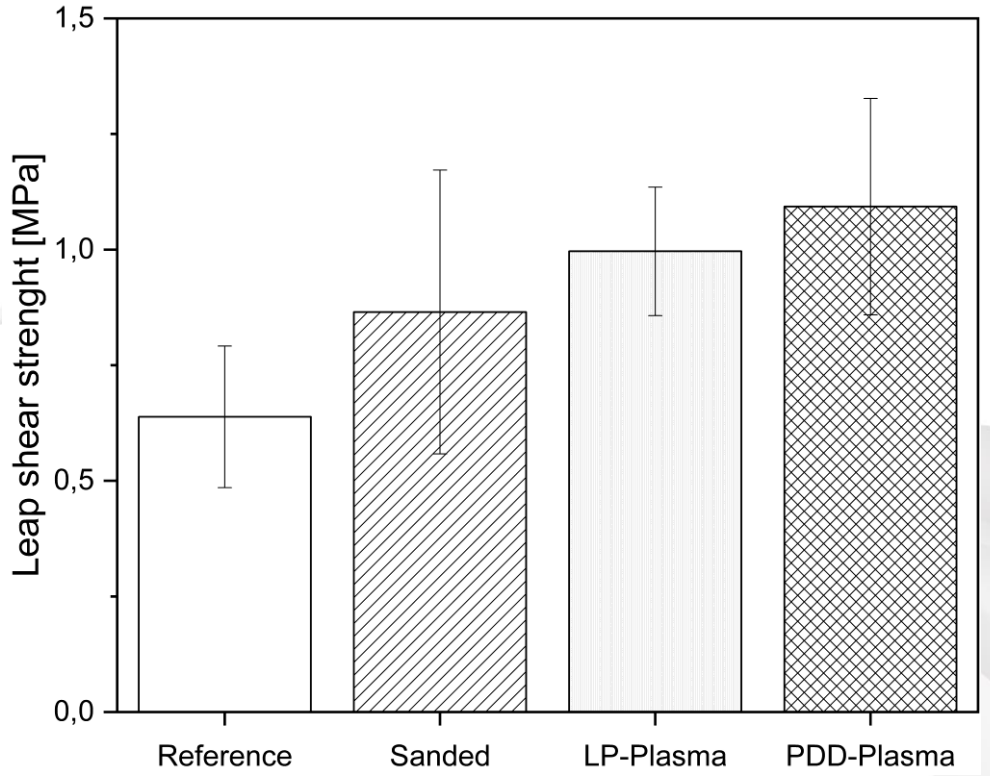
piezobrush® PZ3

Characterization and bonding of plasma modified polyetheretherketone (PEEK) by M. Behnecke



1 min
80 W

1 min
8 W

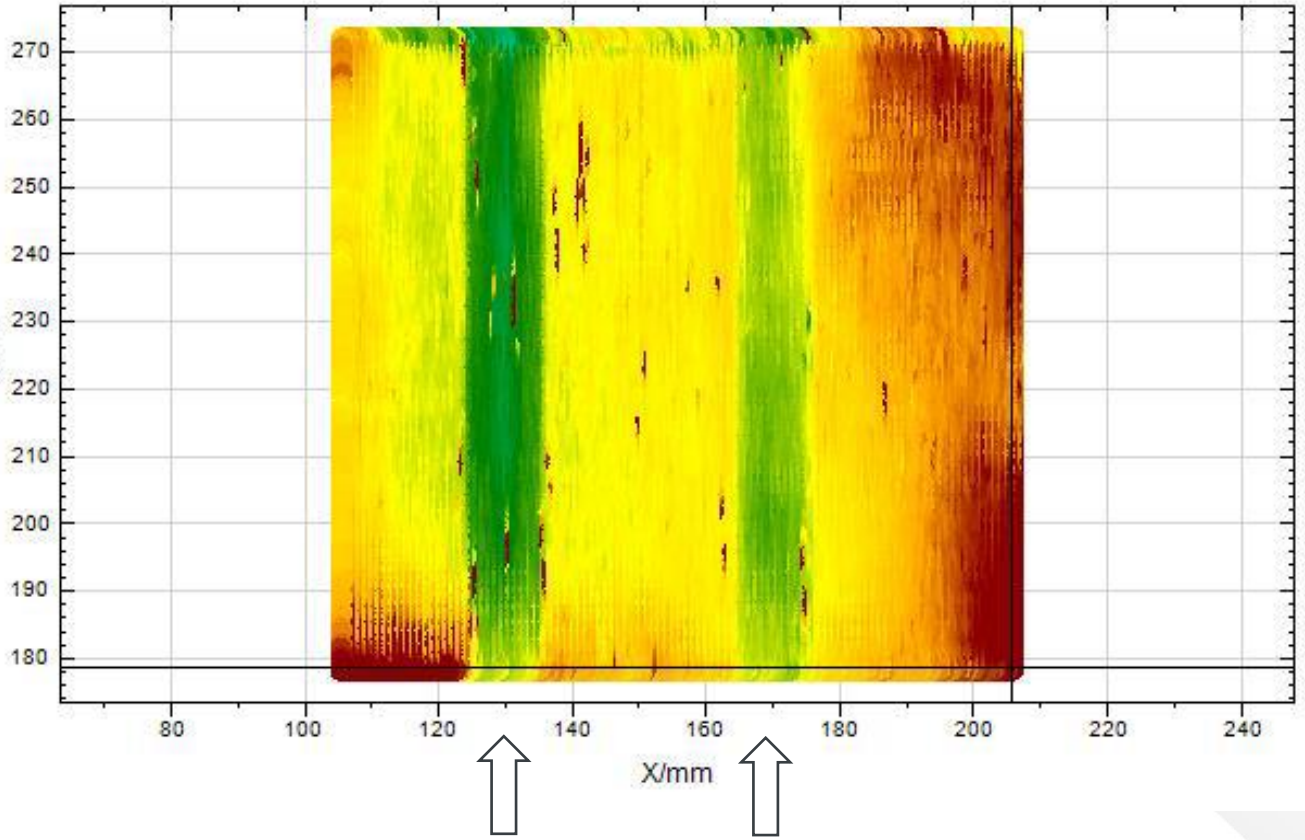


HOCHSCHULE OSNABRÜCK
UNIVERSITY OF APPLIED SCIENCES

Beta test: SITA Messtechnik GmbH

piezobrush® PZ3

Fine cleaning of stainless steel and fluorescence measurements by S. Büttner & L. Freudenberg



Contamination: Fuchs Anticorrit MRK 4

Measurements with *SITA CleanoSpector, SITA FluoScan 3D*

SITA

The new piezobrush® PZ3

The world's smallest plasma handheld device with PDD technology®

- The **piezobrush® PZ3** generates **highly efficient cold plasma** for the **optimization of adhesion processes** like gluing, printing and bonding
- Use on a **variety of materials** like plastic, metals, glass, ceramics, semiconductors, natural materials, etc.:
  - Module "**Standard**" is used for **non-conductive materials** like plastics
  - Module "**Nearfield**" is used for **conductive materials** like metals
- The application of the plasma with the handheld **piezobrush® PZ3** is **easy, safe and intuitive**
- **Process control tools** and **power setting** can be accessed via the **integrated display**
- No external gas supply required thanks to **integrated fan**
- **Plug-and-play technology** requires only a standard wall socket

relyon plasma®

A TDK GROUP COMPANY

Contact details

The Netherlands

Elektrostraat 17
NL-7483 PG Haaksbergen

T: +31 (0)53 573 33 33
F: +31 (0)53 573 33 30
E: nl@texim-europe.com

Belgium

Zuiderlaan 14 bus 10
B-1731 Zellik

T: +32 (0)2 462 01 00
F: +32 (0)2 462 01 25
E: belgium@texim-europe.com

UK & Ireland

St. Mary's House, Church Lane
Carlton Le Moorland
Lincoln LN5 9HS

T: +44 (0)1522 789 555
F: +44 (0)845 299 22 26
E: uk@texim-europe.com

Germany North

Bahnhofstrasse 92
D-25451 Quickborn

T: +49 (0)4106 627 07-0
F: +49 (0)4106 627 07-20
E: germany@texim-europe.com

Germany South

Martin-Kollar-Strasse 9
D-81829 München

T: +49 (0)89 436 086-0
F: +49 (0)89 436 086-19
E: germany@texim-europe.com

Austria

Warwitzstrasse 9
A-5020 Salzburg

T: +43 (0)662 216 026
F: +43 (0)662 216 026-66
E: austria@texim-europe.com

Nordic region

Sdr. Jagtvej 12
DK-2970 Hørsholm

T: +45 88 20 26 30
F: +45 88 20 26 39
E: nordic@texim-europe.com

Italy

Via Matteotti 43
IT-20864 Agrate Brianza (MB)

T: +39 (0)39 971 3293
F: +39 (0)39 971 3293
E: italy@texim-europe.com

General information

info@texim-europe.com
www.texim-europe.com