



MULTI-FUN

ENABLING MULTI-FUNCTIONAL
PERFORMANCE THROUGH
MULTI-MATERIAL ADDITIVE
MANUFACTURING



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SPEEDTECH- FORUMS

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Introducing INOCON

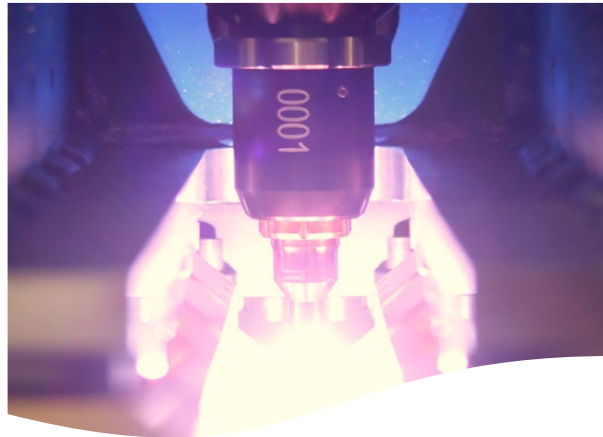


INOCON is located in Attnang-Puchheim, Upper Austria and has currently 50 employees. It was founded in 1994 and since this moment the company has gathered great experience in major fields of plasma applications and special machinery.

Plasma Cleaning/Coating

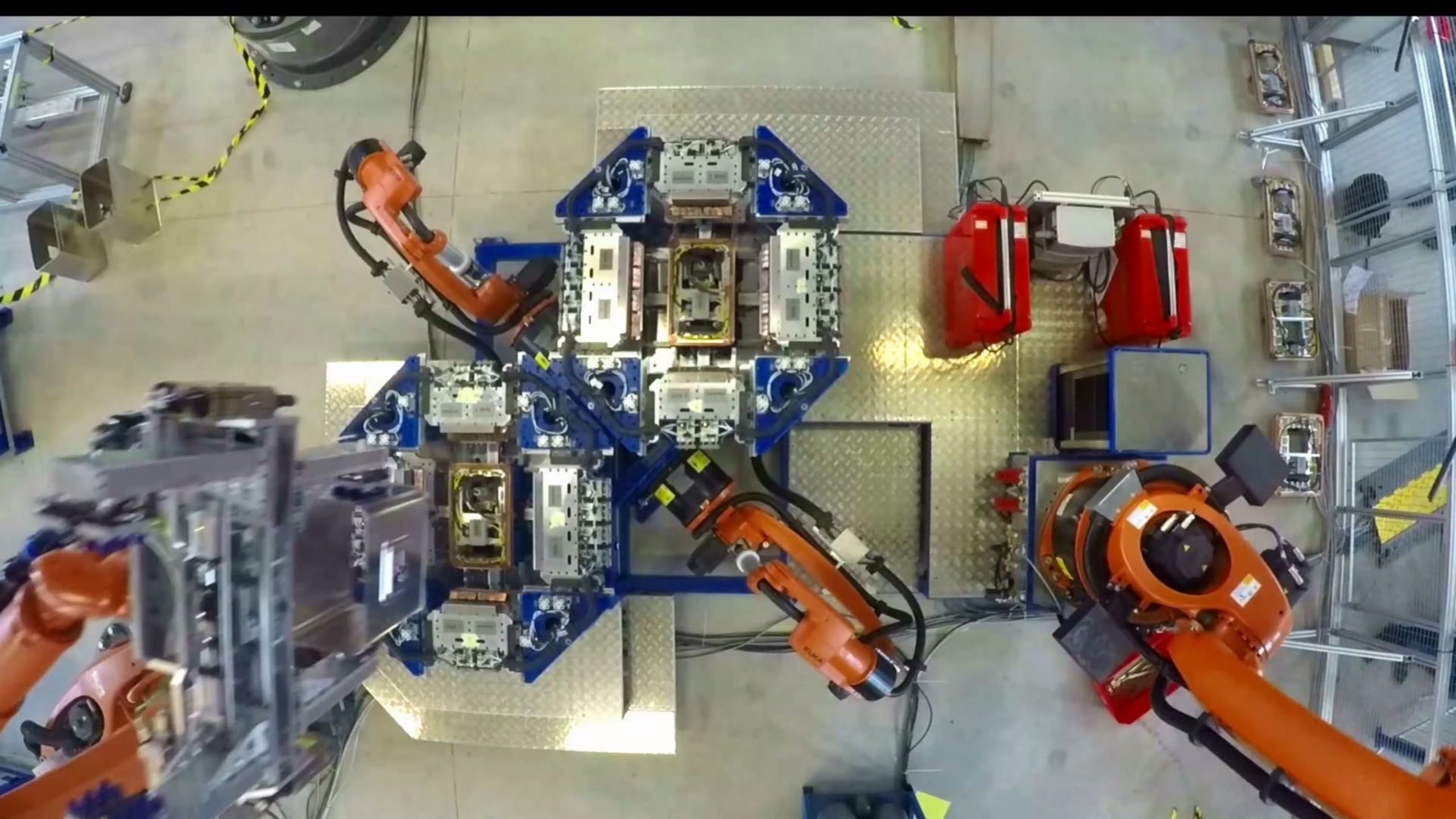


Plasma Welding/Brazing



Special Machinery





Introducing SBI



Plasma welding



- Multi welding process equipment (TIG, Plasma)
- Covered welding range: 0,5A – 500A
- Compact design including cooling

Turnkey Systems



Additive Manufacturing



- Works with Fe, Ti, Al, Mg, ...
- The M3DP is a pure AM-system and therefore has no subtractive function
- Flexible and scalable
- Uses wire, powder or both



Expertise & Strengths



1

R&D Laboratory

2

Product/Process Design

3

Automation

4

Manufacturing

5

Implementation

- Special machinery and process development
- Plasmatron welding and brazing
- Plasma cleaning and processing
- Plasma coating → plasma metallization and functionalization
- Process up-scaling and automation

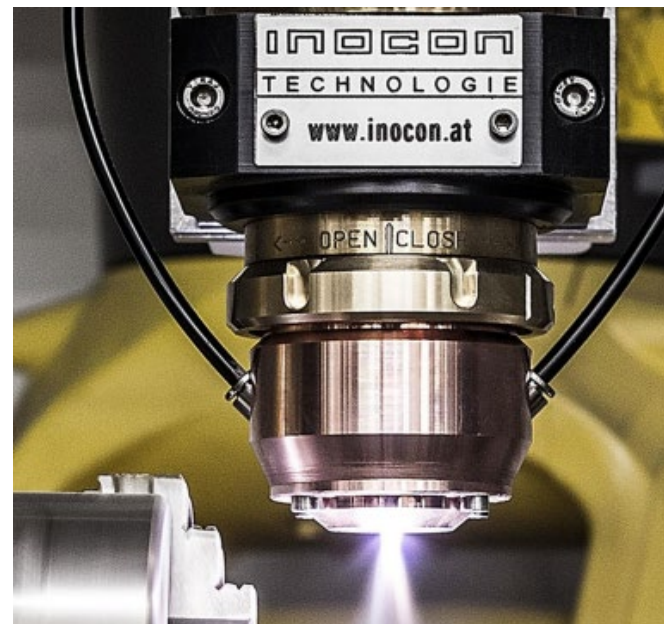


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Expertise & Strengths



InoCoat 3 (hot-plasma)



- Hot plasma source for plasma coating and cleaning (e.g. metallization, deposition of nano-layers, ceramics,...)
- Plasma gases: Argon, Helium, Mixtures
- Plasma power: 2.000 - 17.000 W

Micro Cold Plasma (MCP)



- Cold plasma source for activation and cleaning of i.e. plastic surfaces (3D-printed, foils,...)
- Plasma gases: Pressured air, Nitrogen
- Plasma power: 500 - 2.000 W



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Expertise & Strengths



- Highly flexible plasma processing and process development
 - Additional components / process adaptations / process optimization / automation → all in-house
 - 3D-substrates (AM parts, demonstrators,...)
 - 2D-substrates (adhesive foils, PET,...)
- Multi-material combinations (dissimilar materials)
- Local deposition of metal- / ceramic or HMDSO-coatings (anti-corrosive coatings, wear resistant coatings, low friction coatings,...)
- Customer tailored designing and process development (idea → feasibility study → automation and optimizing → final product)
- Up-scaling of project results

3D-functionalization setup
specimen size: 700 x 400 x 400 mm



R2R 2D-functionalization setup
Roll width of 500 mm

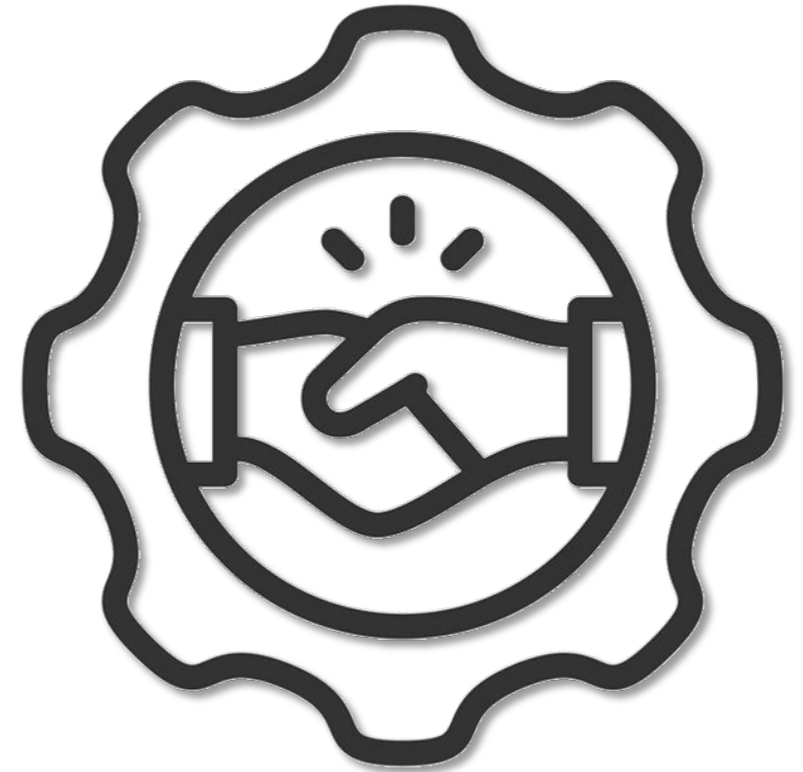


Main Contributions to MULTI-FUN



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- Support and integration of functionalities in WAAM structures (e.g. optical fibres, conductive tracks, ...)
- Development and optimization of APPD parameters to increase the coating properties (porosity, adhesion,...) and the efficiency
 - Evaluation of 2D and 3D substrates
 - Optimization of powder feeding process
- Post-processing (plasma cleaning, plasma metallization,...) of different demonstrators (according to defined use cases)



Main Contributions to MULTI-FUN



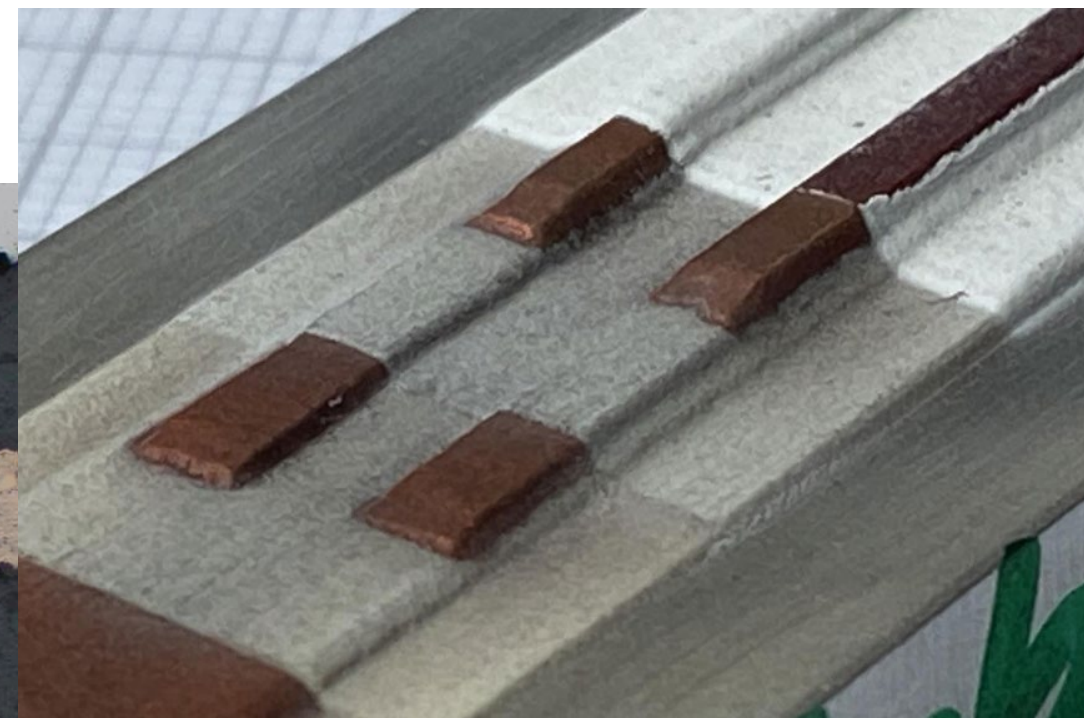
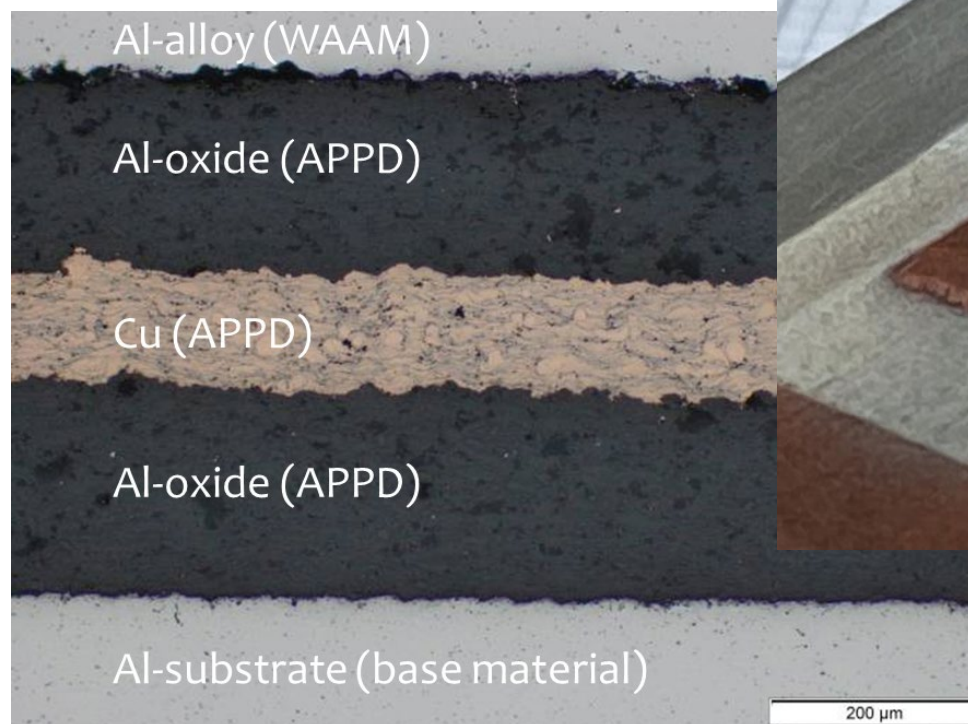
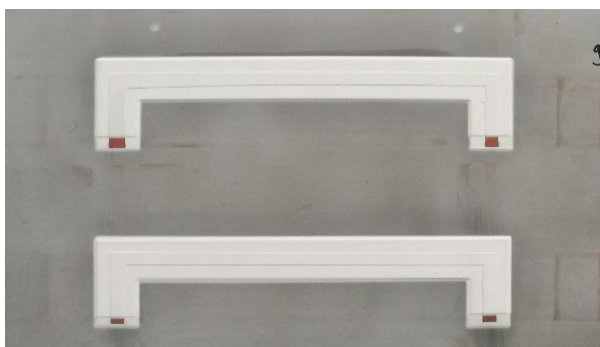
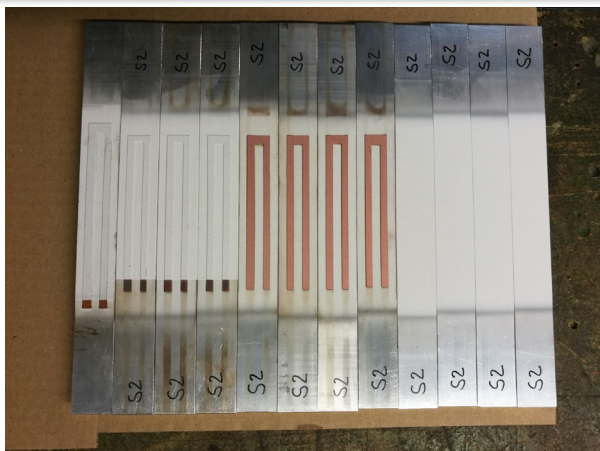
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Main Contributions to MULTI-FUN



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Main Contributions to SUSTAINair



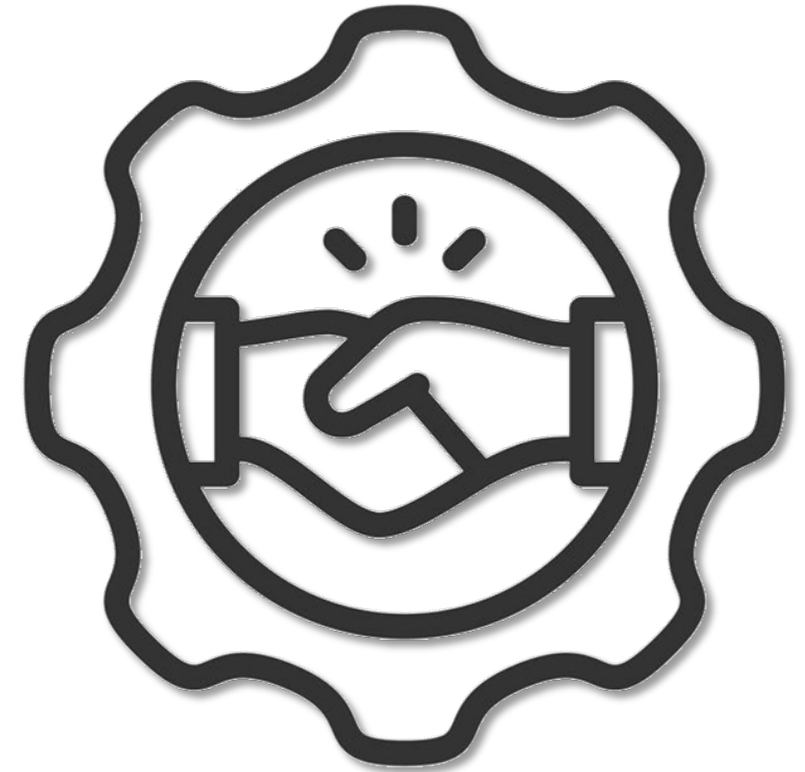
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“SUSTAINair is addressing the major challenge of greening of Aircrafts”

- Enabling lightweight design with fully recyclable materials + embedded functionalities
- SHM integration
- Joining and repair technologies for similar / dissimilar aerospace grad material combinations

INOCON's main role in SUSTAINair

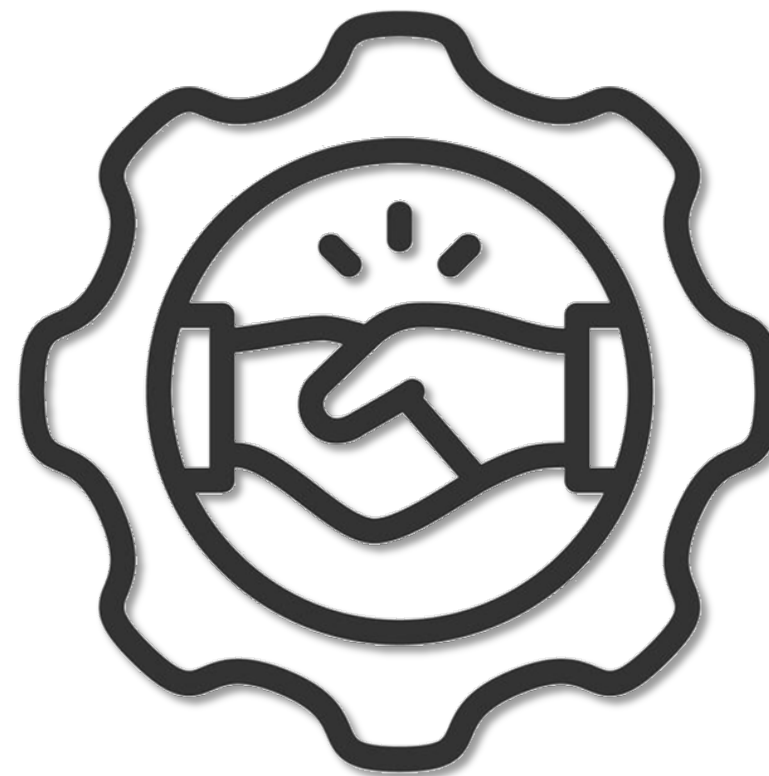
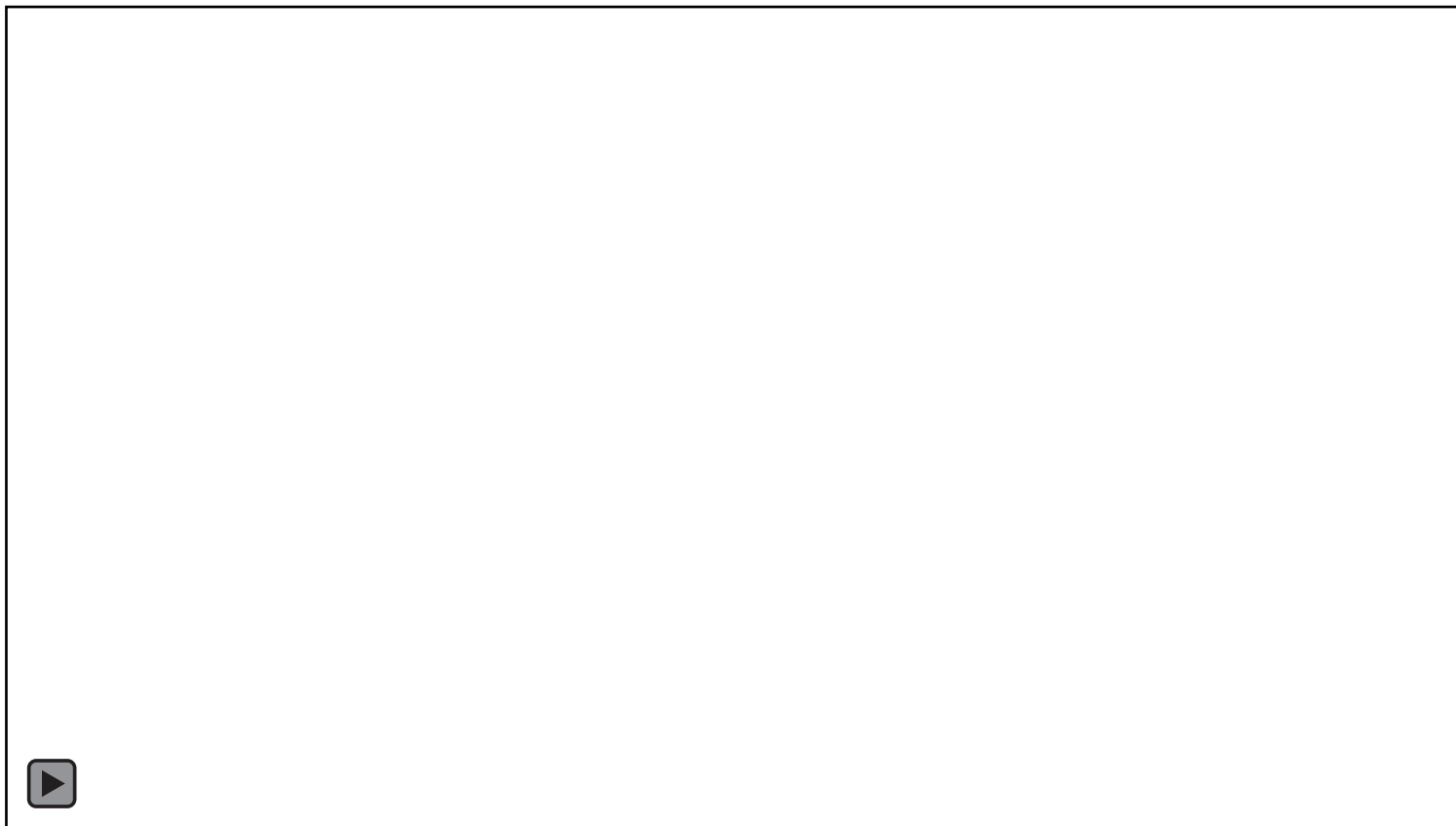
1. Supporting project partners with plasma technology to obtain sensor material → sensor manufacturing
2. Deposition of conductive tracks and patches and/or nano-sealings by precursor deposition
3. Implementation of additional functions and system integration on structural aircraft components



Main Contributions to SUSTAINair



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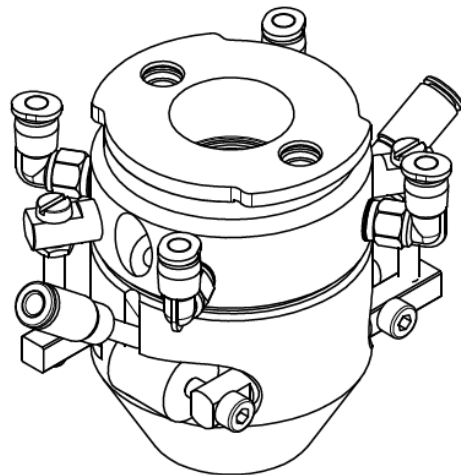


Main Contributions to SUSTAINair

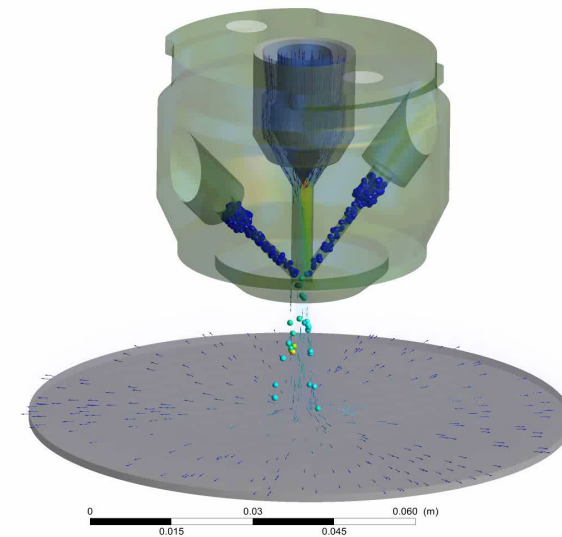
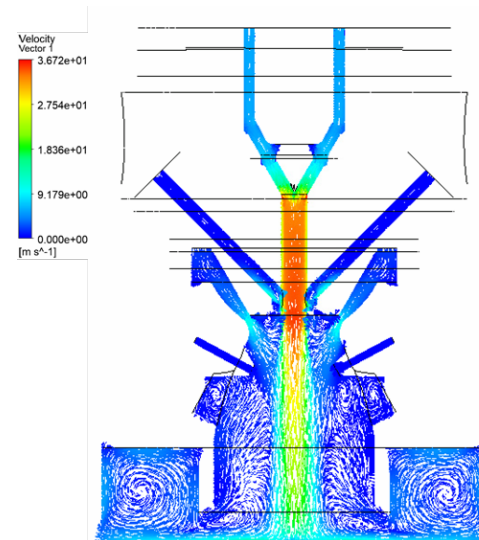


Generation of sensor material and functionalization of Al- and CRFP-substrates → Adaption of the current plasma torch design necessary

- Torch optimization / adaption by CFD-Simulation
- Designing and manufacturing of different plasma torches tailored on project needs → increased efficiency for specific coating material → **Plasma Shrouding torch**
- Testing scenarios (T-measurements, U/I, cross-sections,...)
- Evaluation and Optimization of powder handling and powder feeding



Adaption of the IC3 basic geometry by a modular Plasma Shrouding add-on (SUSTAINair)



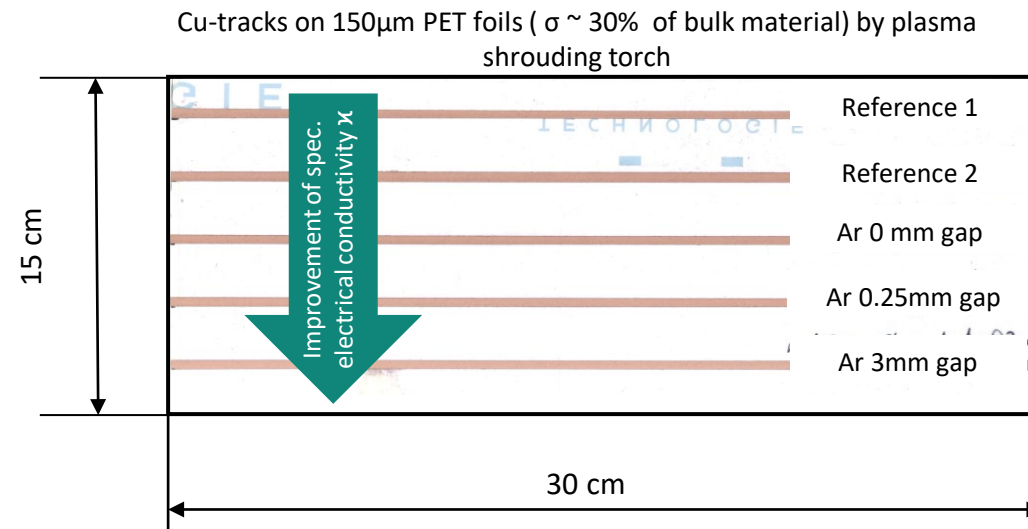
Particle analysis and parameter optimization by CFD-analysis

ANSYS
R19.0
Academic

Main Contributions to SUSTAINair



- Process development by CFD-Simulation
- Parameter optimization by numerical and experimental approach
- Local deposition of Cu-tracks and conductive patches for e.g. SHM-Systems → **increase of electric conductivity +27 % due to Plasma Shrouding torch**
- Combination of insulation and conductive materials (low porosity) at **process speeds of > 200 mm/s**
- Deposition of Cu-tracks on AM substrates and sensitive substrates possible (e.g. adhesive foils,...)



Different Cu-tracks on PA substrate – the shapes were created by locally applying an anti-adhesive varnish

Main Contributions to We3D



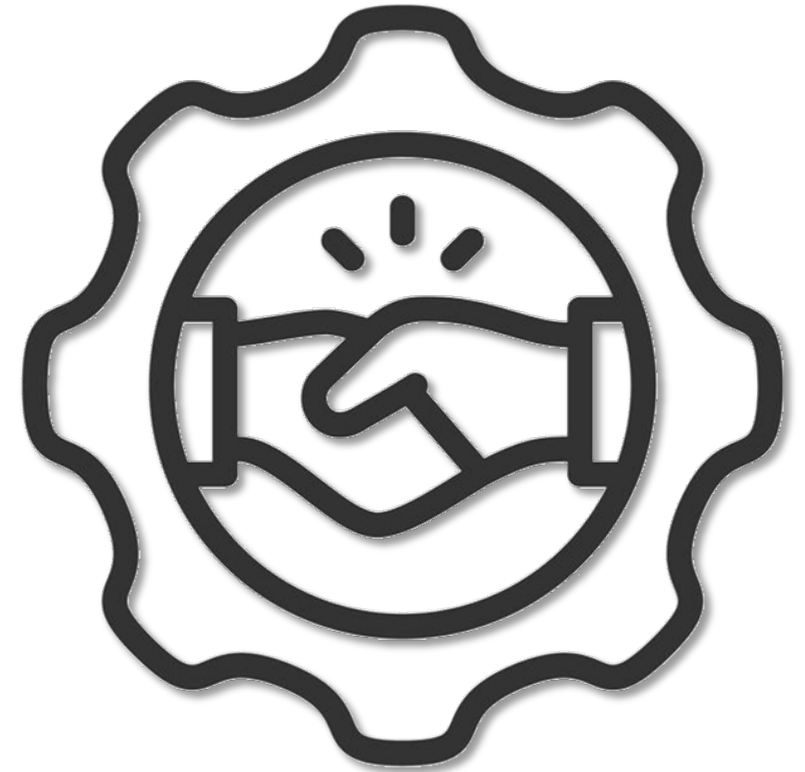
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“We3D strives to take WAM and the consortium partners competences to a new level”

- Optimize existing and develop novel light metal alloy wires (Aluminium and Titanium)
- Novel WAM-specific wires shall allow WAM parts with superior properties for aerospace, automotive and industrial applications
- Realize a system (hardware and software) for fully automated WAM in the future

INOCON’s main role in We3D

1. Supporting project partners with plasma technology for coating tests
2. Deposition of the developed and newly produced powders



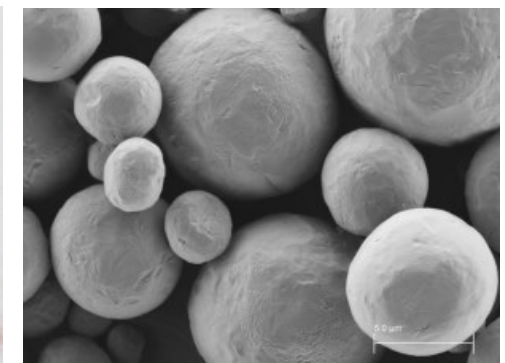
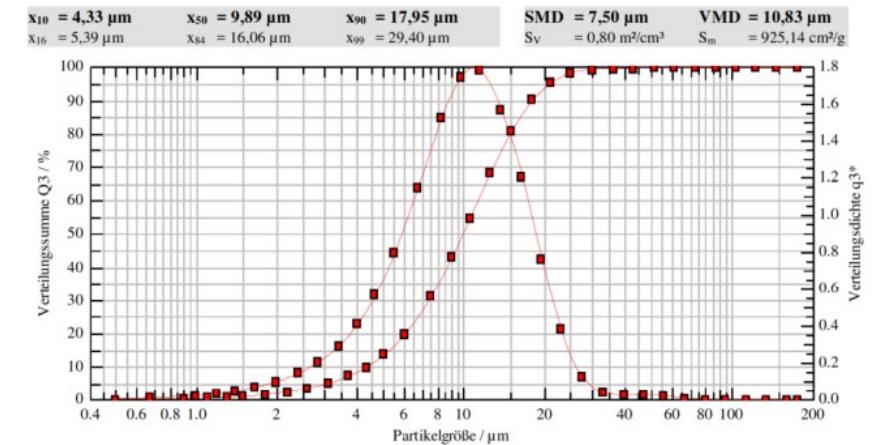
Grainsize

< 15 μ m

- flowability important
- particles with spherical shape (gas atomized)
- additives if needed (e.g. for better flowability)
- tight grain size range (e.g. D10/50/90 of 5/10/18 μ m)

> 15 μ m

- particles with sputtered shape (water atomized)
- particles with blocky shape (sintered and crushed)
- less additives needed (e.g. for better flowability)





Innovation Potential



1) Functionality and sustainable process

Partial or full-bodied coating of different substrates and continuous products

Compared to chemical coating process **no dangerous waste disposal**
No toxic plasma gases used for processing (Air, N₂, Ar) → simple exhaust system

2) Efficiency und quality

Short cycle times due to modern plasma technology
Fully integrable in existing process routes and production lines
Reproducible quality of coated samples



3) Flexibility

Coating of different substrate materials, even sensible ones – e.g. invar, aluminium, polymers, optical fibres, ...

Thank You!

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