



Leibniz Institute for Plasma
Science and Technology e.V.
(INP Greifswald)



Catalysing plasma technology in the food industry

Jörg Ehlbeck & Christian Theel

Flanders' FOOD Technology Days, Brussels, Nov. 13, 2014

FROM THE IDEA TO THE PROTOTYPE

INP Greifswald – Facts

Main building (new building 1999)

Main floor space 3.700 sqm

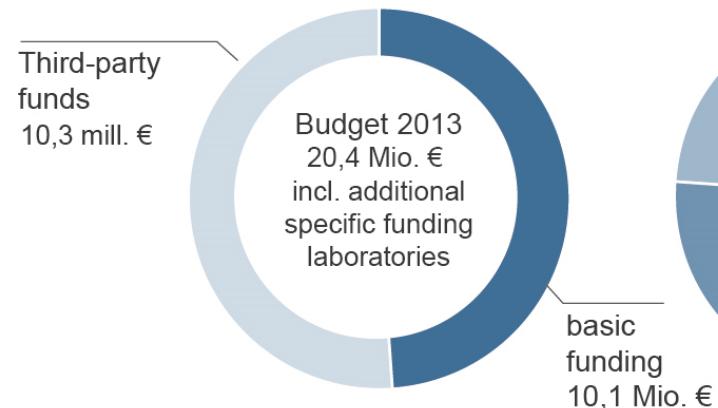
130 workstations

41 laboratories

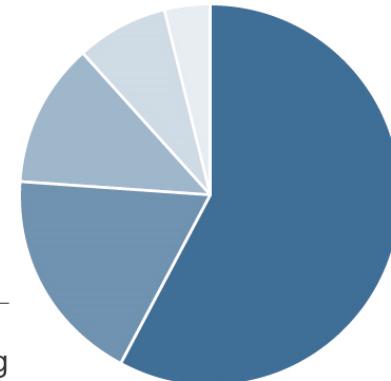
Extension building 540 sqm
(30 workstations, 8 laboratories)



Budget (2013)



Staff (2014)



196 Employees (September 2014)

- science/engineering 124
- assistance/trainees 25
- administration/infrastructure 26
- marketing/management support 14
- guests 7

Plasma: The 4th state of matter

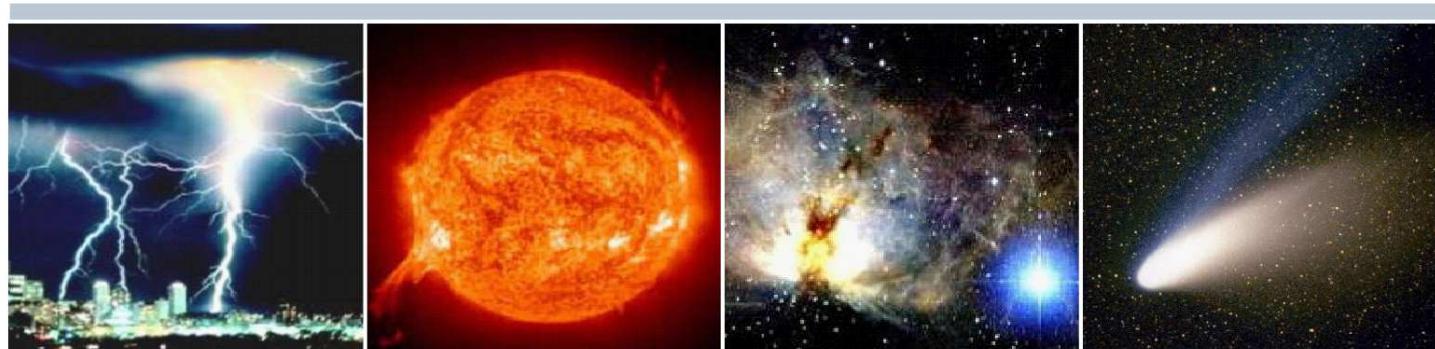
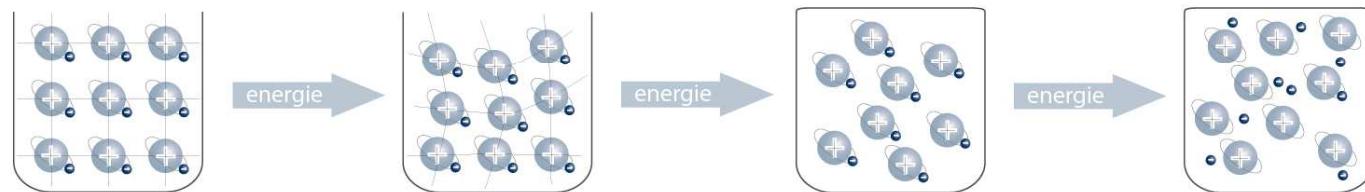


solid

liquid

gas

plasma

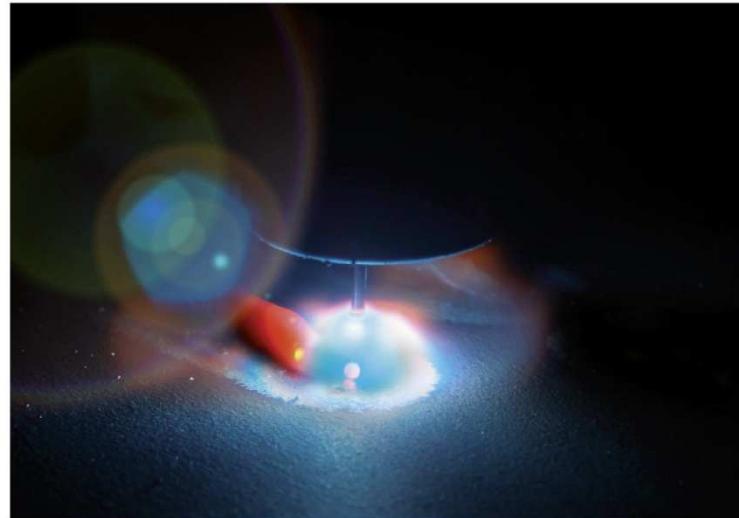


More than 99% of all known visible matter is in plasma state!

Current Research Divisions

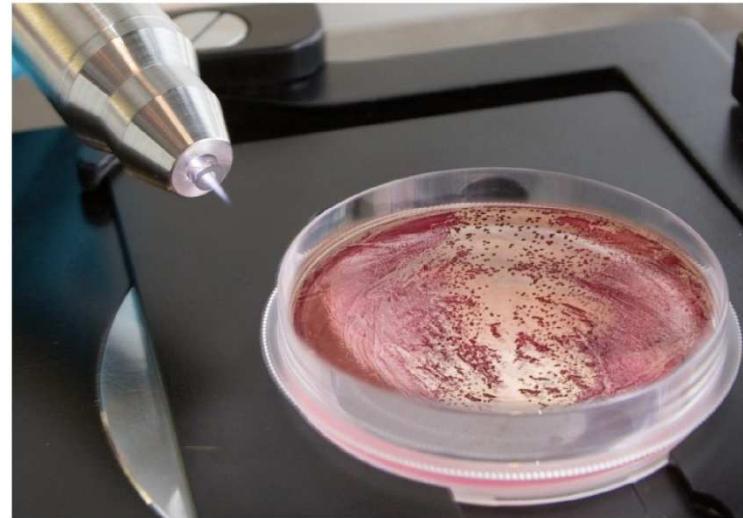
Research Division Materials & Energy

Prof. Thomas Schoenemann



Research Division Environment & Health

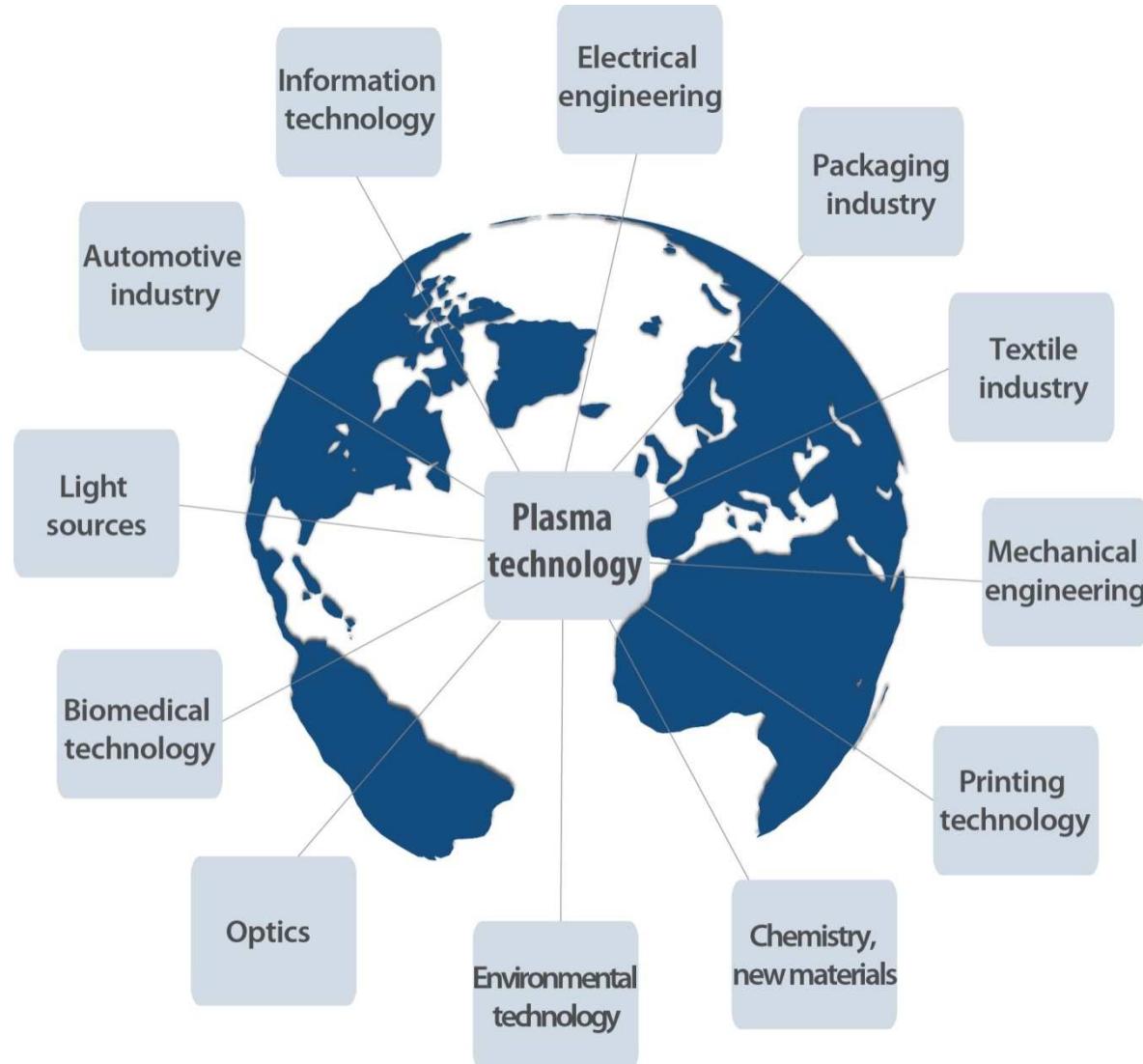
Prof. Klaus-Dieter Weltmann



- Renewable energies (fuel cells, solar energy generation)
- Functional surfaces and materials (a.o. optical technologies)
- Energy efficient processes (welding, switching, light)
- Plasma process diagnostics- and monitoring

- Decontamination / sterilization
- Medical devices
- Food
- Hygiene
- Clean water / clean air
- Therapeutic applications

Plasma technology – application areas



Transfer – 3 column model

FROM THE IDEA TO THE PROTOTYPE



FROM PROTOTYPE TO PRODUCT



neoplas tools
medical plasma

neoplas control
solutions for your operations in gases and plasmas

FROM THE PRODUCT TO THE MARKET

Transfer - Cooperation





Our world is plasma

Discover the fascinating opportunities for your enterprise



Cooperation network Plasma4Food

Realizing a vision



FROM PROTOTYPE TO PRODUCT

Development, construction
and marketing of
plasma-based systems for
efficient and mild
decontamination of

- Food
- Production environment and
- Food packaging



Partners in the network



FROM PROTOTYPE TO PRODUCT

- Leibniz Institute for Plasma Science and Technology (INP Greifswald)
- Leibniz Institute for Agricultural Engineering Potsdam-Bornim (ATB)
- Fraunhofer Institute for Process Engineering and Packaging IVV
- Technology Transfer Center ttz Bremerhaven
- INNOVENT Technology Development Jena
- Neubrandenburg University of Applied Sciences
- 14 SMEs along the value chain
- 10 associated partners in 5 countries



Associated partners



FROM PROTOTYPE TO PRODUCT



SURFACE|PLASMA
Líder em tratamentos de superfície



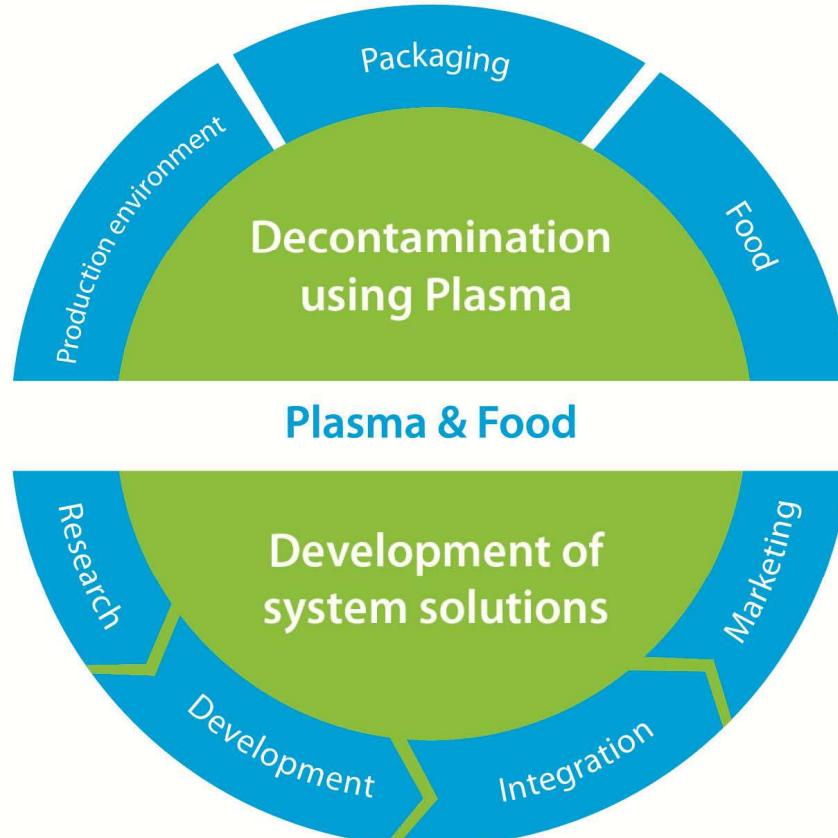
DANISH
TECHNOLOGICAL
INSTITUTE



30 Partners & many competences

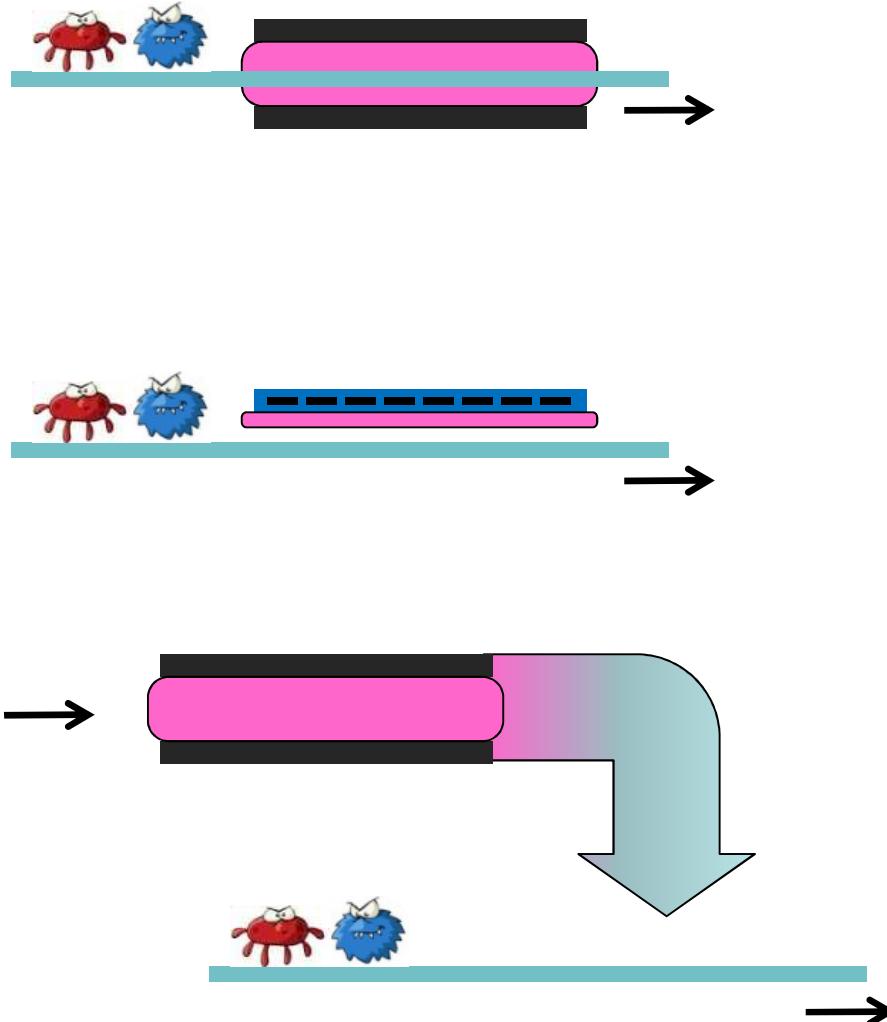


FROM PROTOTYPE TO PRODUCT



- Plasma and microwave technology
- Sensory analysis
- Food chemistry
- Microbiology
- Food technology and Food safety
- Process engineering & mechanical engineering
- Technology transfer and marketing

Types of plasma treatments



Meat - DBD

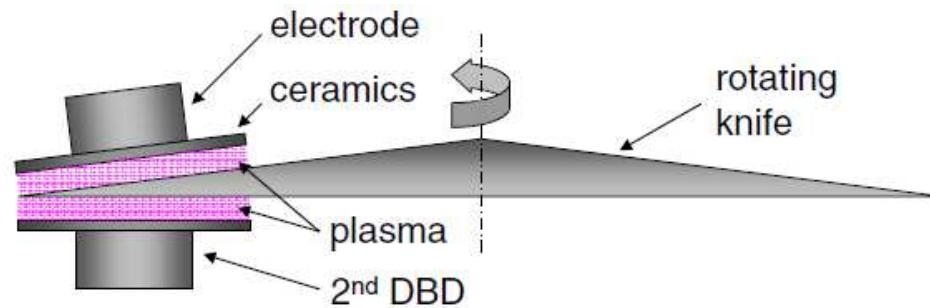


Figure 7. Sketch of the experimental setup for plasma surface decontamination of a circular knife used for slicing in the meat industry (according to Leipold *et al* (2010)).

PlasmaLabel (Jürgen Engemann Plasma Consult)

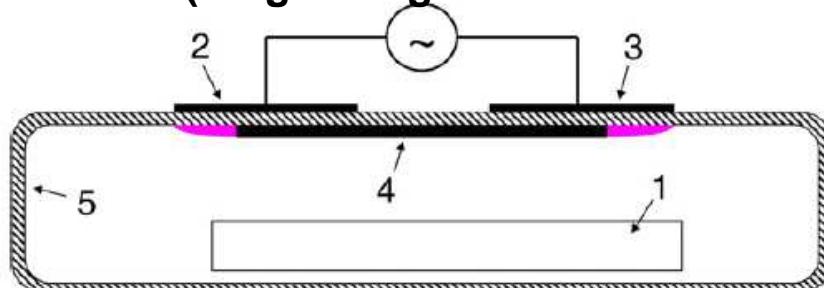
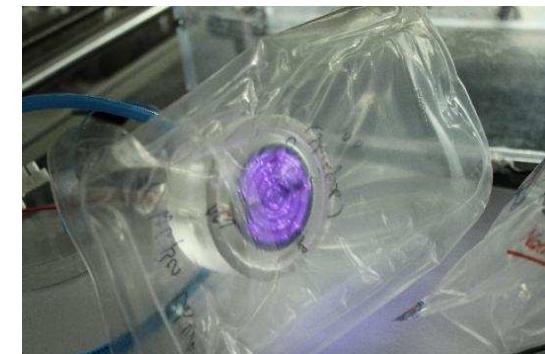


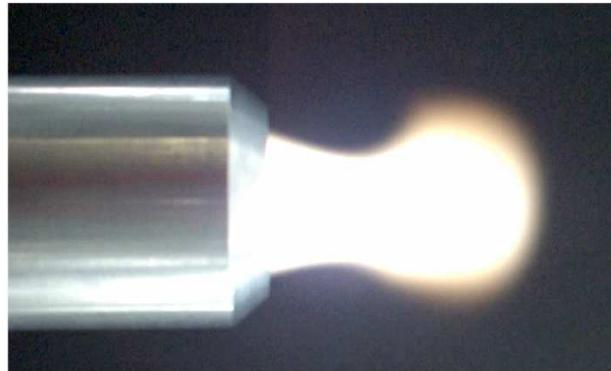
Figure 8. Scheme of PlasmaLabel concept with the goods to be disinfected (1) inside the closed package (5), two powered electrodes outside the package (2 and 3) and an inner electrode (4) (according to Schwabedissen *et al* (2007)).

PlasmaElectrode (INP)



Plasma processes - microwave excitation

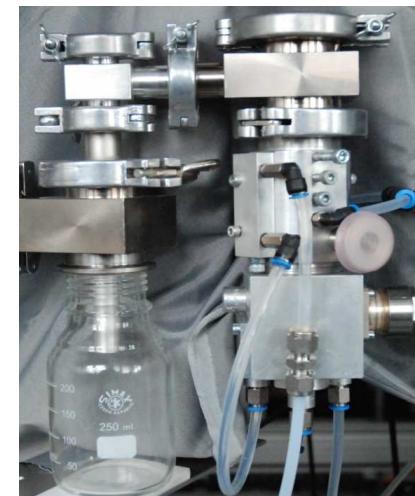
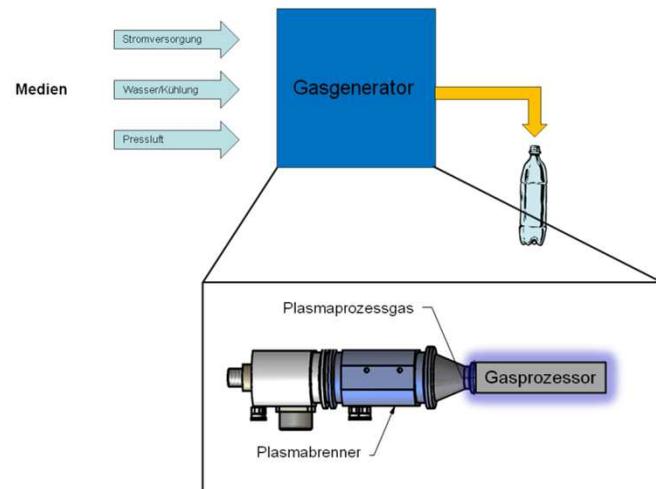
Plasmatorch: PLEXC



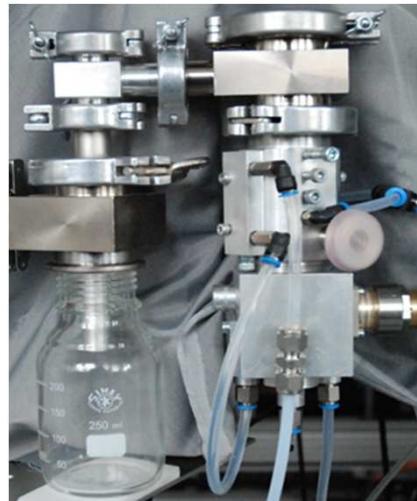
Implementation:
Batch-process
for medical products



Implementation inline for cold aseptic filling

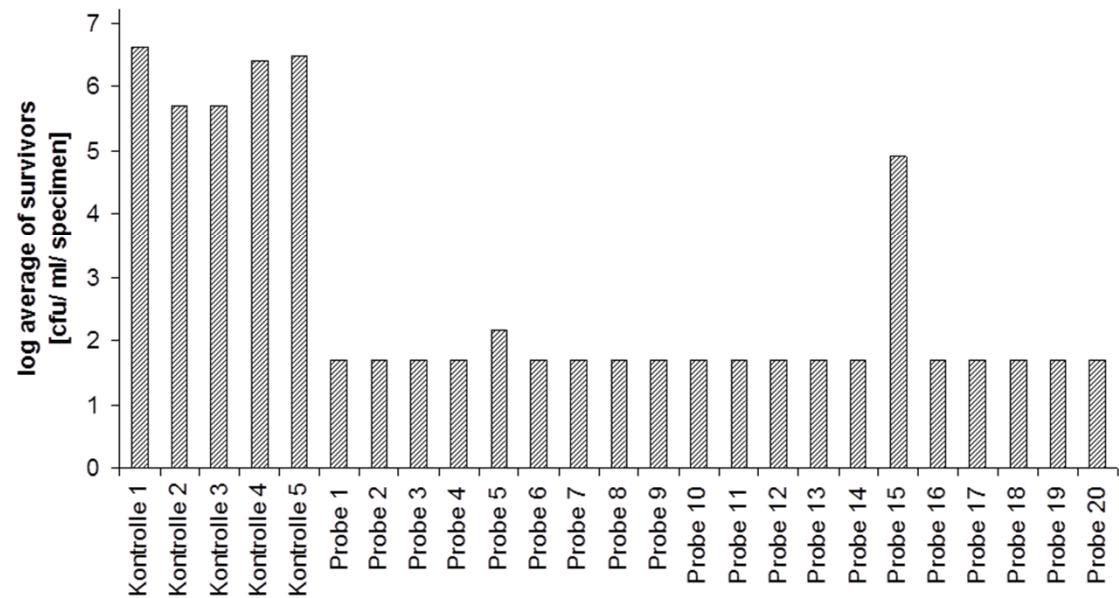


Packaging – PET bottles (PPA)



PPA-technology (Plasma Processed Air)

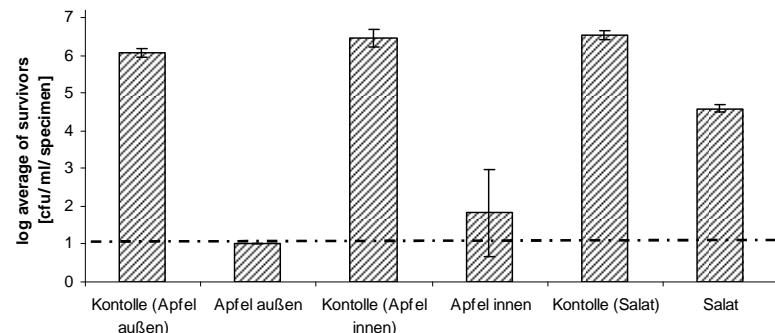
B. atropphaeus Endosporen
20 s mit plasmaprozessierter Luft behandelt



Fruits, vegetables and salad – (PPA)

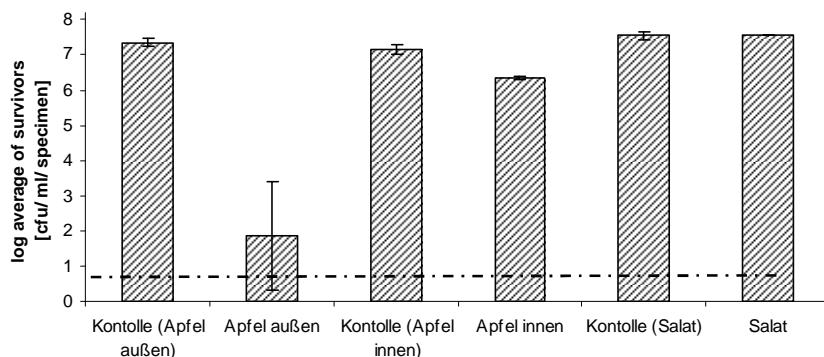


E. coli on fresh-cut food treated with microwave plasma excited air for 15 minutes



Reduction of 1,93 up to 5,07 \log_{10}

B. atropphaeus endospores on fresh-cut food treated with microwave plasma excited air for 15 minutes



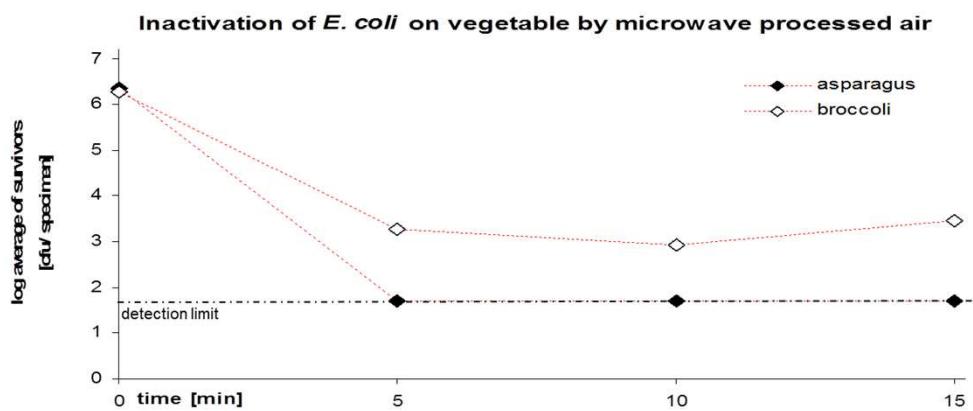
Reduction of 0 up to 5,48 \log_{10}



Fruits, vegetables and salad – Brokkoli (PPA)

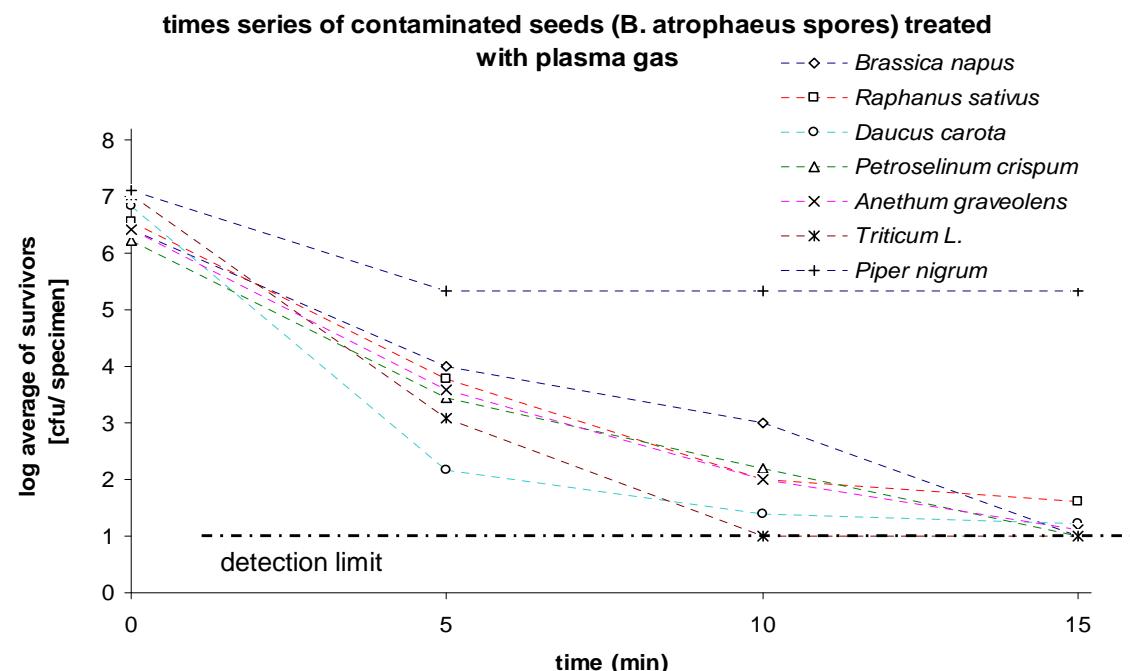


In cooperation with
GKZ Gültzow



Application of plasma technology for mild conservation using the example of perishable post harvest food products (FriPlas)

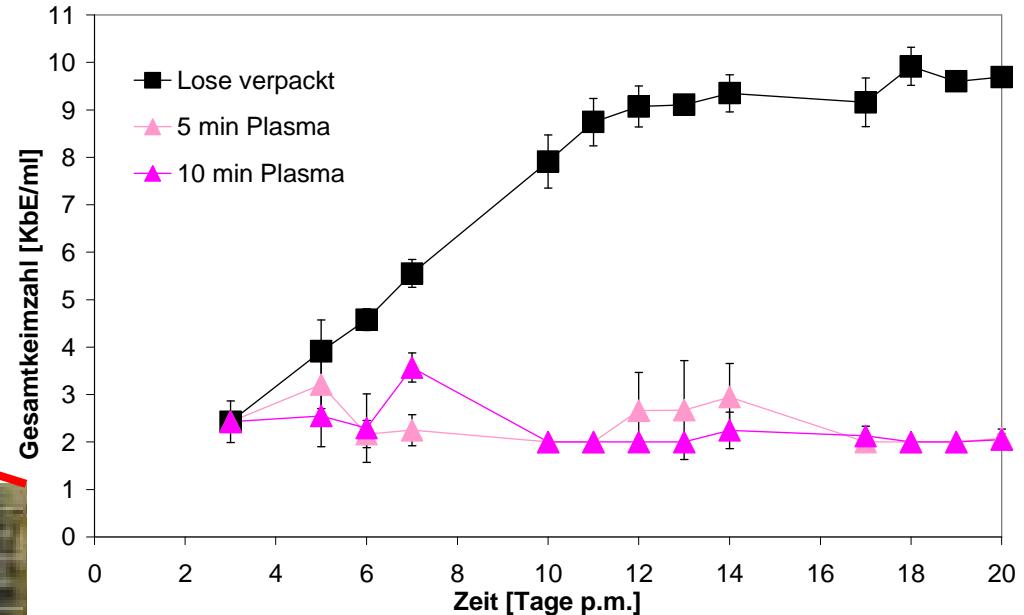
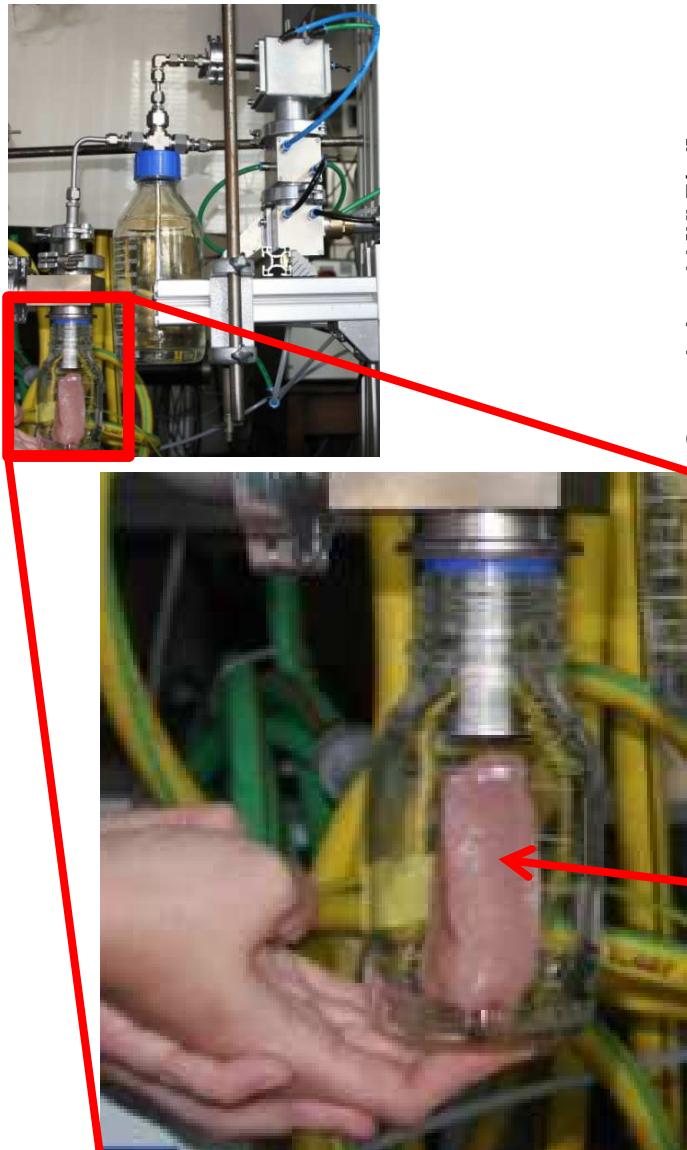
- Treatment of seeds with plasma excited air
- Plasma parameters: 7 seconds plasma (16 slm air)
- Incubation times: 5', 10', 15'



Reduction rates:

Rapeseed	$- 5,41 \log_{10}$
Garden radish	$- 4,95 \log_{10}$
Carrot	$- 5,63 \log_{10}$
Parsley	$- 5,23 \log_{10}$
Dill	$- 5,3 \log_{10}$
Wheat	$- 6,02 \log_{10}$
Pepper	$- 1,77 \log_{10}$

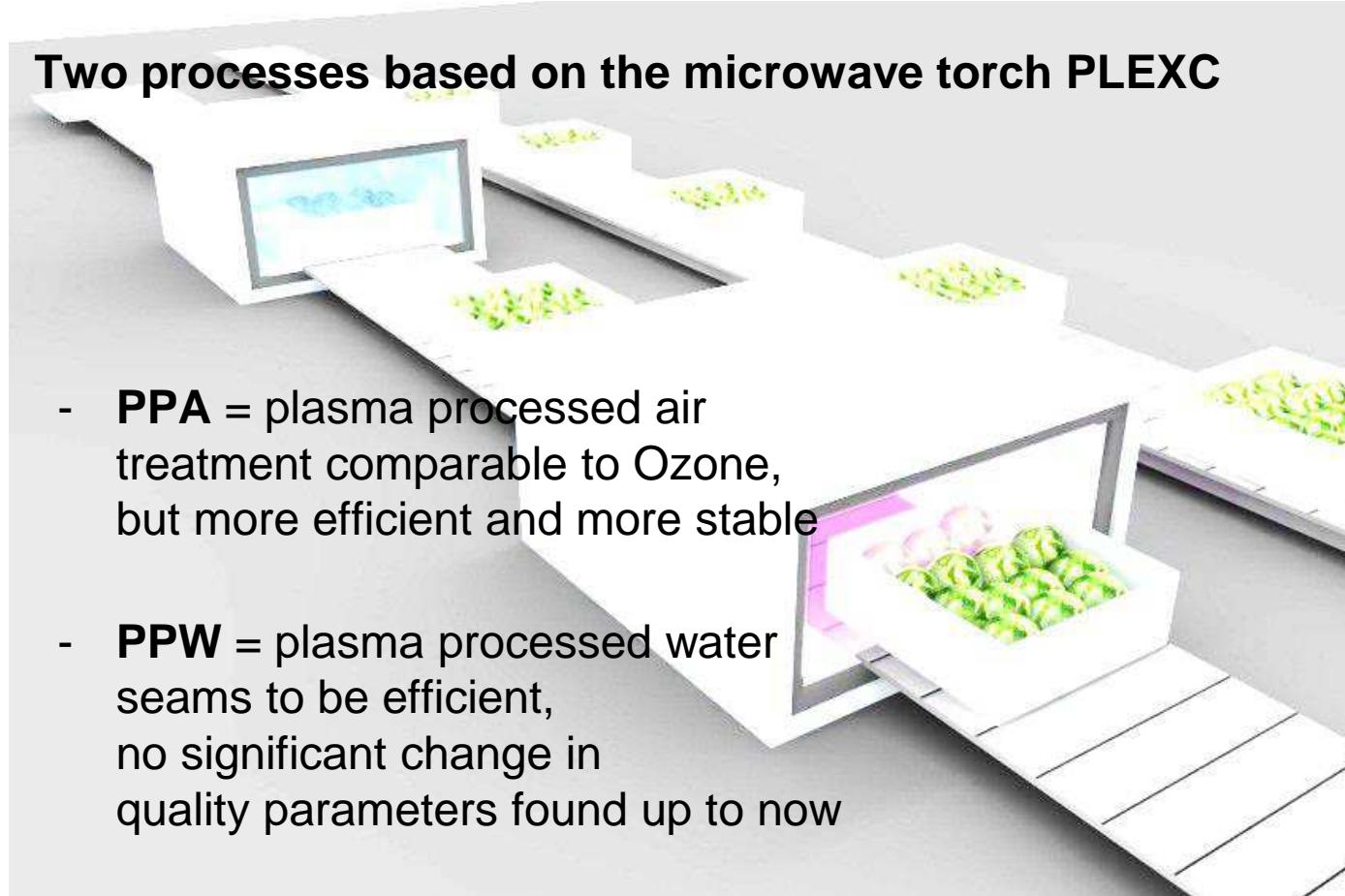
Meat – indirect plasma treatment (PPA)



Summary

- DBD surface dielectric barrier discharges offer a lot of special applications

- Two processes based on the microwave torch PLEXC



- **PPA** = plasma processed air treatment comparable to Ozone, but more efficient and more stable
- **PPW** = plasma processed water seems to be efficient, no significant change in quality parameters found up to now

We offer...



FROM PROTOTYPE TO PRODUCT

- ✓ R&D cooperation with well-known research institutes and industry partners
- ✓ Joint project development
- ✓ Product and process innovation
- ✓ Expertise and clarification of legal frame conditions
- ✓ Customer focused technology marketing



We welcome...



FROM PROTOTYPE TO PRODUCT



- new partners, who are willing to contribute to the development of new practical solutions
- all enquiries concerning decontamination in food industry



Please visit: www.plasma4food.de



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