

Surface Treatment Solution Fluorination of all Plastics



Fluor

“The **tiger** of
chemistry”

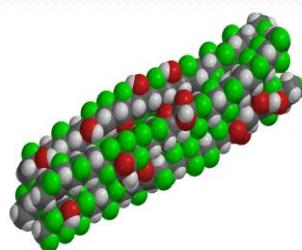
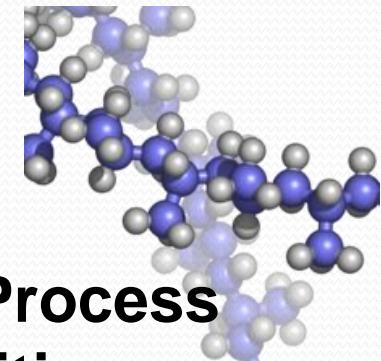


WOLTERING
VERFAHRENSTECHNIK

Fluorination – with innovated Solution for Aktivation and Pretreatment of Polymers

Fluorination a wonderful tool for surface pretreatment

- **What is Fluorination?**
- **Influence of Process Parameter**
- **Fluorination in industriel Applications**
- **Variation of the Fluorination process**
- **Modules for the OFFLINE-Fluorination Process**
- **Fluorination with small pieces and quatities**
- **Fluorination contract based / external**



..... Indroduction

– the experts in Fluor

Surface treatment with Fluor = 20 years Experience

Now in EURO5



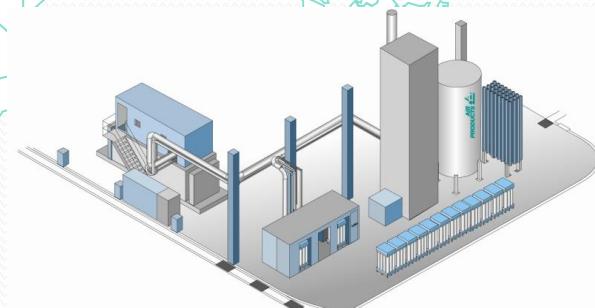
Auto Fuel tanks



Activation of Plastic surfaces



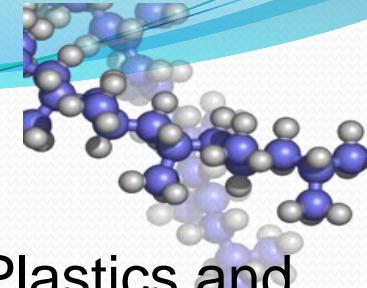
Canister for Food, Solvents
Chemicals, Medical Applications



Turn Key Surface Treatment Facilities

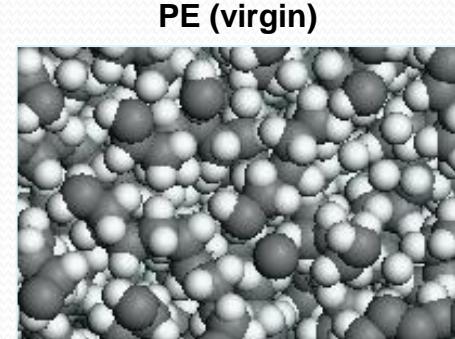
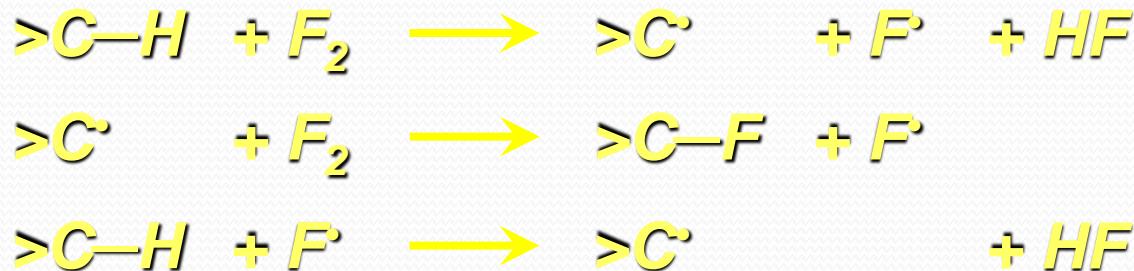
What is Fluorination?

What is Fluorination?

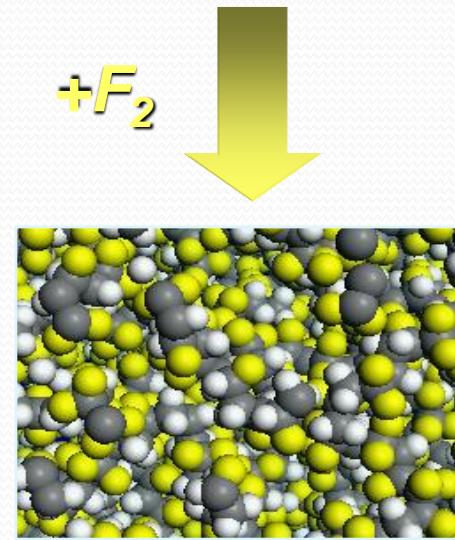


- Surface treatment of all Plastics and other materials with dry gaseous Fluor.
- Gas mixtures of 1 to 20% F_2/N_2
- The fluorination gives new and unique properties of plastic surfaces and materials.
- Targeted adjustment of pre-, intermediate and final products to the requirements of the processing or later using

Barrier fluorination as surface treatment



- Self initiation of complex chain process of ambient or elevated temperature
- The reaction mechanism is accelerated with increasing temperature (50-70°C)
- About 3 / 4 of hydrogen bound in the polymer interface is replaced by fluorine



OXI® – Fluorination as surface pre treatment solution

Fluor byself...

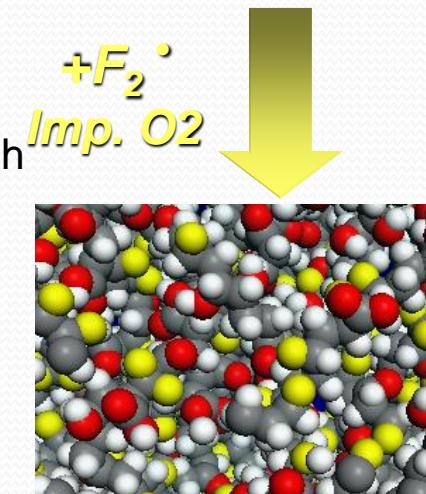
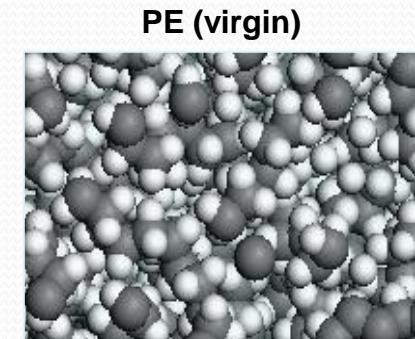
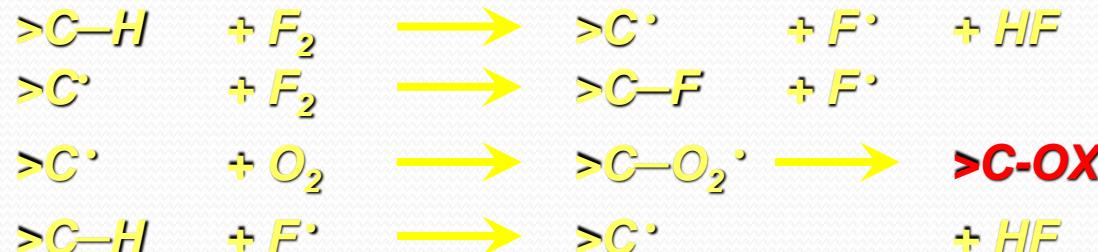
- produces a very fast and effective oxidation process

Expected to...

- hydrophilen Function groups in the fluorinated matrix/ Carbonyl-/Carboxyl-Groups
- improved, chemically produced upper surface wettability

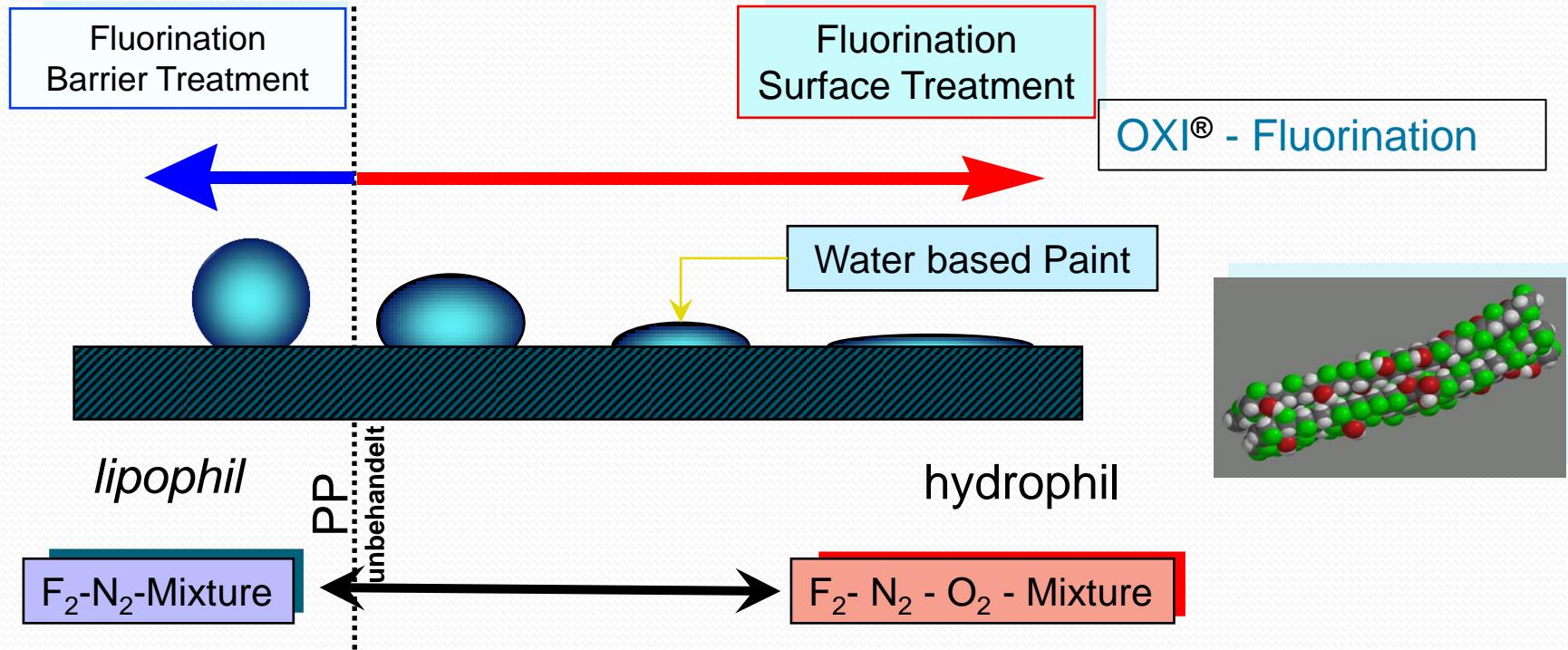
Additional...

- Reaction leads to the formation of any "weak boundary layer"
- not abrasive, even checking
- sustainable participatory >12 months after storage/Powerwash



+ F_2 •
Imp. O_2

Perception about the classic drop....



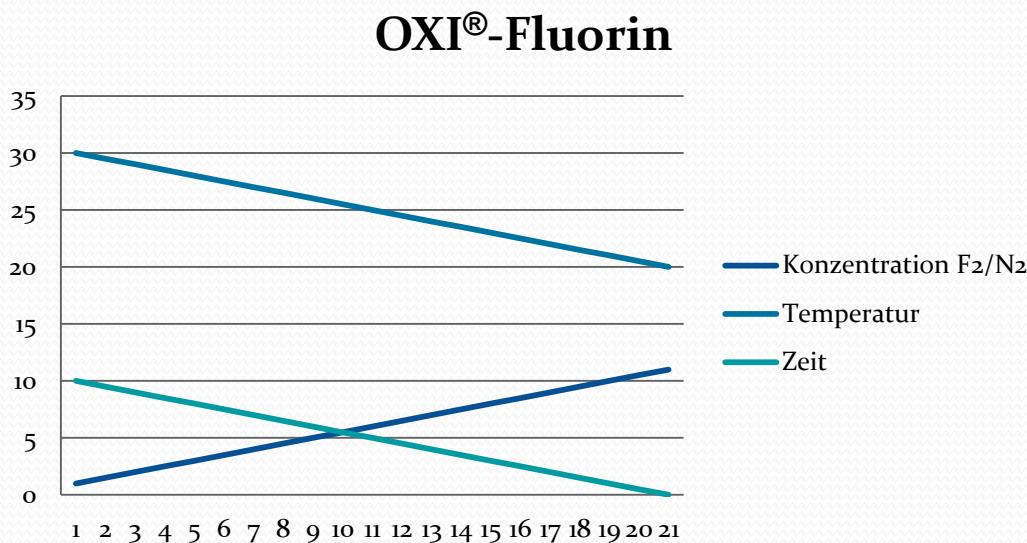
- Is a substitution of the surface by the action of a fluorine / nitrogen mixture on the base material- Carboxyl-/Carbonyl- und Hydroxyl-Groups will be created.
- The bonds show up as functional thin film with up to 10nm.
- Functional thin films finally determines the Dipole - Dipole - interaction of the support material (PP, PE, PA, etc.) with the different types of coating.

Combine of different Process parameter

Combine of different Process parameter

OXI® - Fluorination significantly increases the surface energy of the polymer:

- Degree of increase is dependent on the adjusted process parameters - time, concentration, temperature



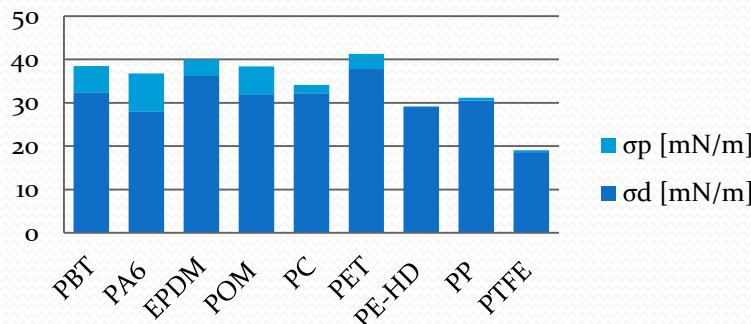
OXI® – Fluorination / dispers und polar

	Not treated		pretreated		
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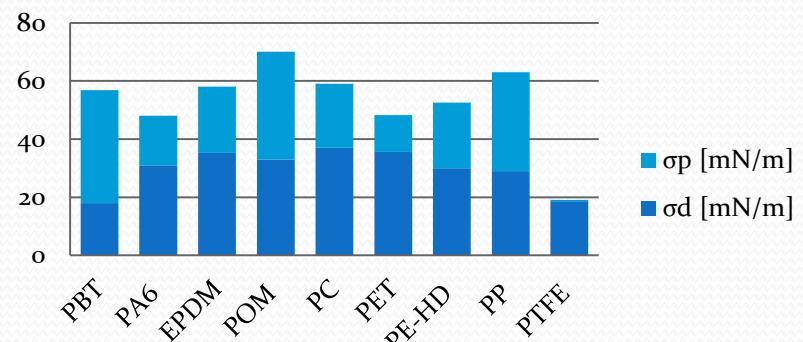
Werkstoff	σ^d [mN/m]	σ^p [mN/m]	σ [mN/m]	σ^d [mN/m]	σ^p [mN/m]	σ [mN/m]
PBT	32,4	6,1	38,5	18	38,8	56,8
PA6	27,9	8,9	36,8	31	17	48
EPDM	36,2	3,8	40	35,3	22,7	58
POM	32	6,4	38,4	33	37	70
PC	32,2	1,9	34,1	37	22	59
PET	37,8	3,5	41,3	35,6	12,7	48,3
PE-HD	29	0,2	29,2	30	22,5	52,5
PP	30,5	0,7	31,2	29	34	63
PTFE	18,6	0,5	19,1	18,6	0,5	19,1
Quecksilber	-	-	484	-	-	484
Wasser	-	-	71	-	-	71



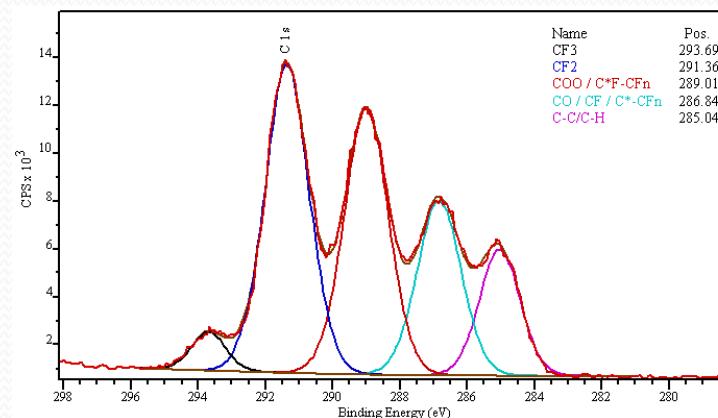
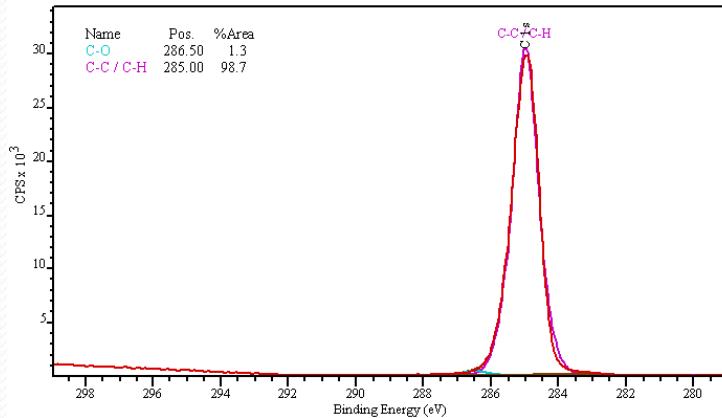
Not treated



With pretreatment



XPS – before and after the fluorine treatment

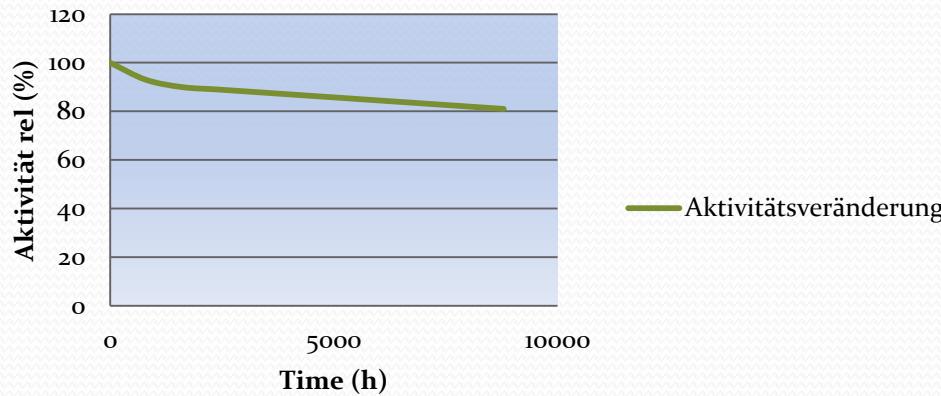


PE / XPS results					
At%	C	F	O	N	Summary
Non treated	99,1	0	0,9	0	100
treated	45,6	47,1	6,2	1,1	100

OXI® – Fluorination – Surface Treatment

treatment stability and Key property

Long term stability after storage and Powerwash



van der Waal Effect

- In seconds created
- Limited number of parameters to monitor
- Treatment independent of:
 - of complex 3-dimensional bodies
 - hollow bodies and sharp lines with undercuts
- High Level of Treatment stability
- 100% reproducible process
- ohne thermic Loading
- Suitable for almost all plastics

Fluorination in industrial application

Fluorination in industrial application

Barriere Treatment

- Tanks, bottles, containers
- aromas of fruit juice
- containers for pesticides,
- oil and fuel tank
 - chemicals,
 - Solvent
- Forming of plastic hollow molding composites
- Cosmetic packaging
- Medical Applications
 - Containers for infusion
 - Containers for blood plasma



Surface Treatment

- Adhäsion, Hydrophil
- Painting and Flocking
- Verbinden von Materialien
- Water based paint
 - without Primer
- Gluing of Polymers
 - each others
 - with other Materials
- Natural and synthetic fibers
- Membrans
- Filter material
- Materials for House building (Fiber Materials)
- Foam
- Foils



Uniqueness in the concrete processing

- Fluorinated PP Fibers
- Innovative design with concrete
- Strengthening of concrete with loose iron elements
- (Foundations, Street surface,

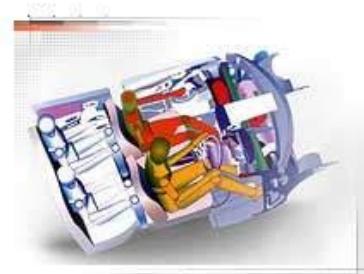
- Adding polypropylene to the concrete
- More possibilities of forming of concrete parts
- Stronger flexibility
 - Concrete is more easily and longer-lasting
 - No Corrosion



Variation in the Fluorination process

Variants of the Fluoration process in the application

- **INLINE,**
 - He mainly is used for the production of plastic containers. We consider this variant in the present-day context not in-depth.
- **OFFLINE,**
 - the best known of in the application surface activation



OFFLINE - Fluorination



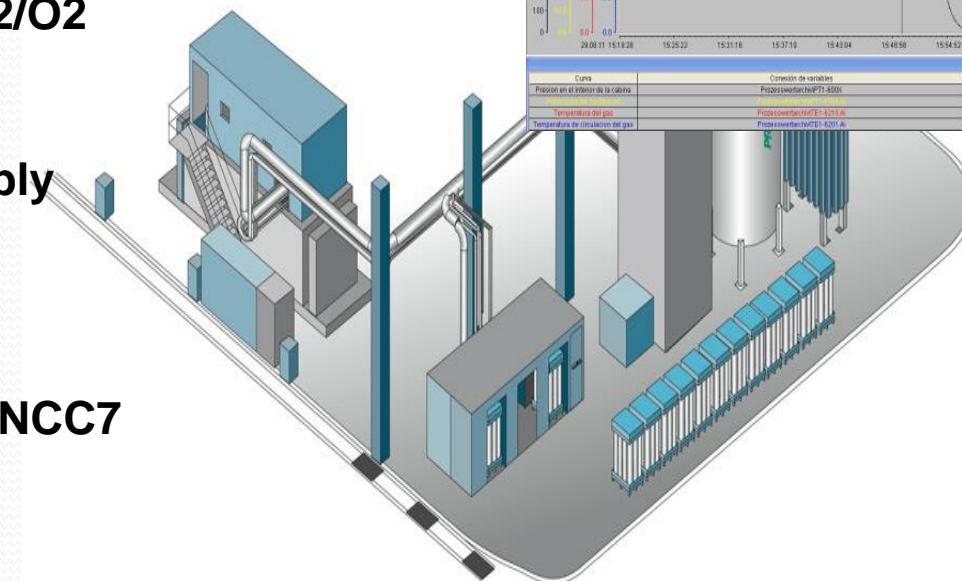
- Activation in separate, downstream process
- Can be used independently of existing production processes
- Parts are dealt with in a vacuum chamber
- Simple for operation

Sample for 6m³ Chamber

OFFLINE - Fluorination

:

- Applications for all materials
- Process in Vacuum chamber, up to 40 m³
- Plant design as customer requirement
- Process temperature, 25 – 40 °C
- Fluor concentration:
 - Dosage and treatment depending on the material
 - Reaction time with F₂/N₂/O₂
 - 1 s bis 15 min
- 100% reproducible process
- 10% (20%) F₂ in N₂ Gas supply
- Vacuum pump set
- Vacuum chamber
- Scrubber
- PLC and/or PC based on WINCC7
- MAK monitoring on F₂



Example of a complete treatment facility 25m³

Modules of the OFFLINE-Fluorination systems

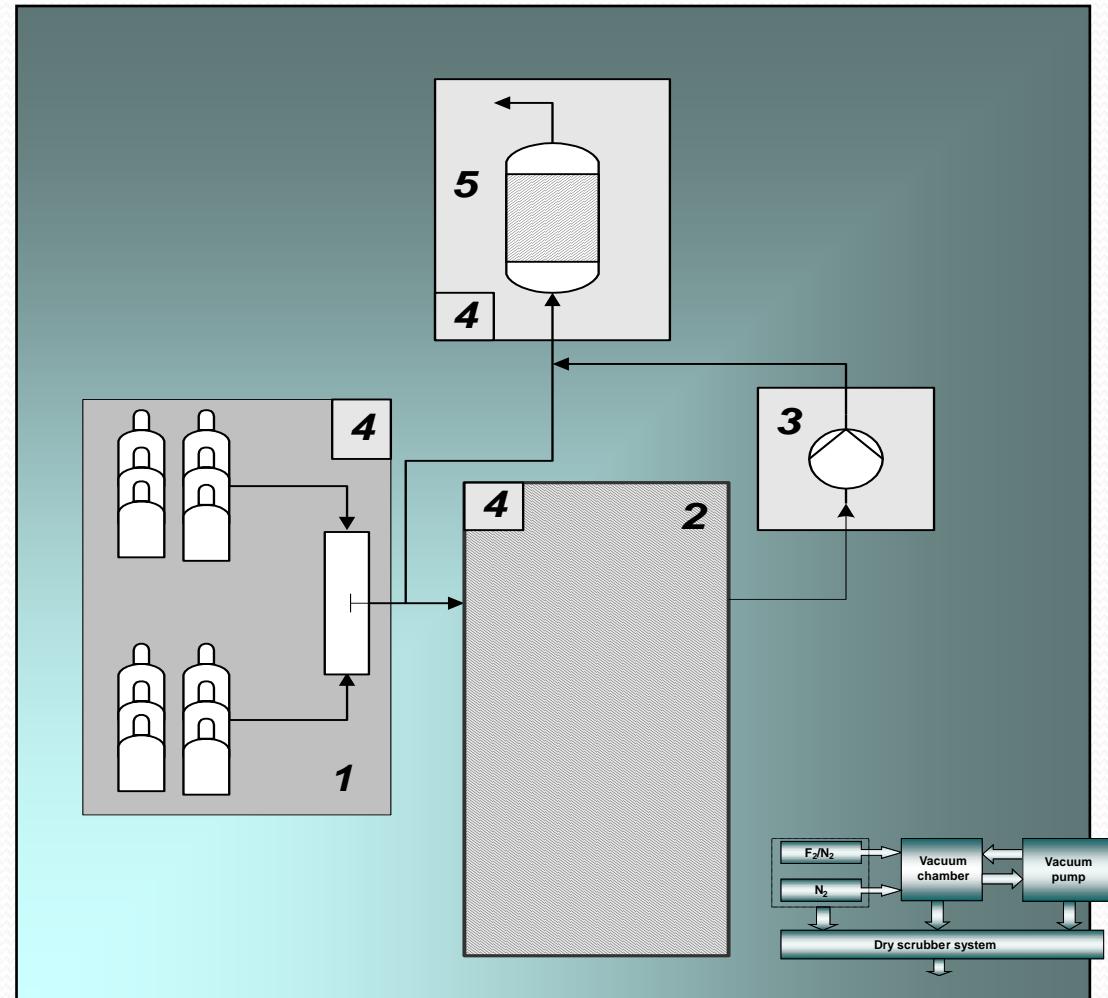
OFFLINE – Fluorination

What kind of modules are necessary....

Representation of a "typical installation"*

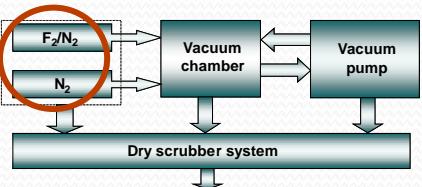
- Gas supply system (1)
- Fluorination chamber (2)
- Vacuum pump set (3)
- Gas monitoring (4)
- Scrubber (5)

* *Another design of equipment for the treatment of films, fibres and textiles on request*



OFFLINE – Fluorination

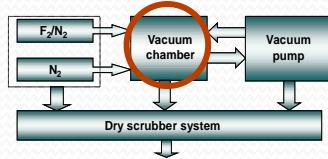
Gas supply systems



- Single cylinder
- cylinder pack
- Tube-Trailer

OFFLINE – Fluorination

Vacuum chamber adapted to customer needs.....

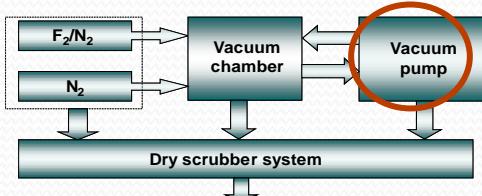


OFFLINE – Fluorination

Vacuum pump set

Here something from the new concept will be soon
seen.....

- What will not change:
 - Maintenance requirement
 - Modular and compact
 -



OFFLINE – Fluorination

Scrubber systems – typical Scrubber examples



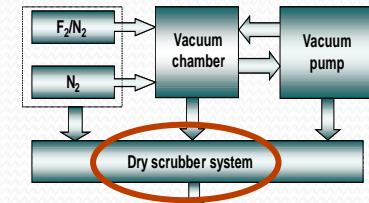
CaCO₃ Scrubber unit

- large facilities
- 20' and 40' Versions
- Absorption capacity, 3 – 5 %

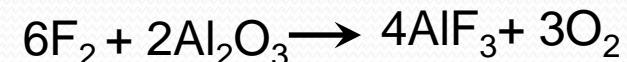


Al₂O₃ –Scrubber unit

- small facilities
- designing free and easy
- Absorption capacity, 70 %



CaF₂ :



Al₂O₃ :

Fluorination - also for small production runs

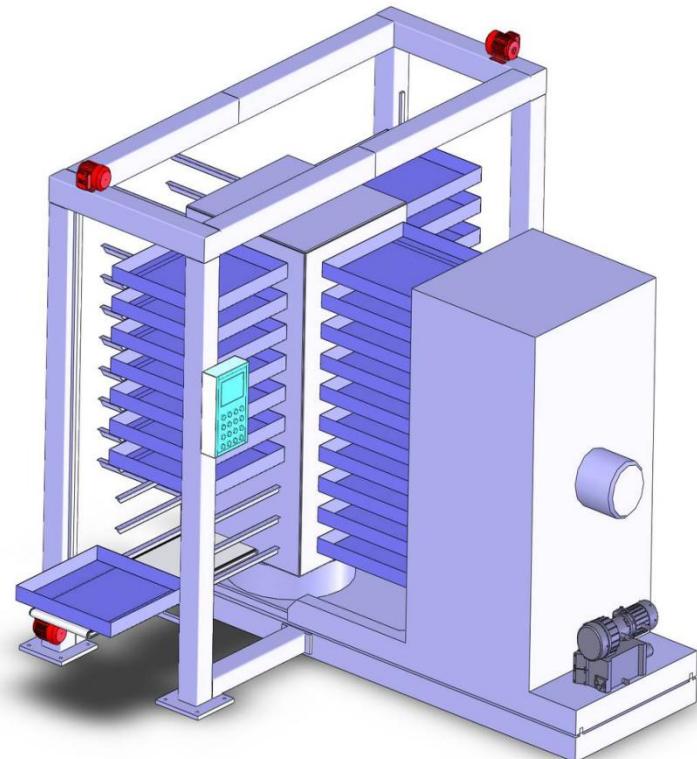
- Chamber size from 100 litres
- Extrem compact design
- Lay out, 2 m x 2 m x 2 m for
 - facility components
 - gas supply station
- Functionality of a large plant
- Easy procedure with the government
- No safety restrictions
- Ideal for small production runs



Fluorination as new innovation in a painting line

It is also INLINE.....

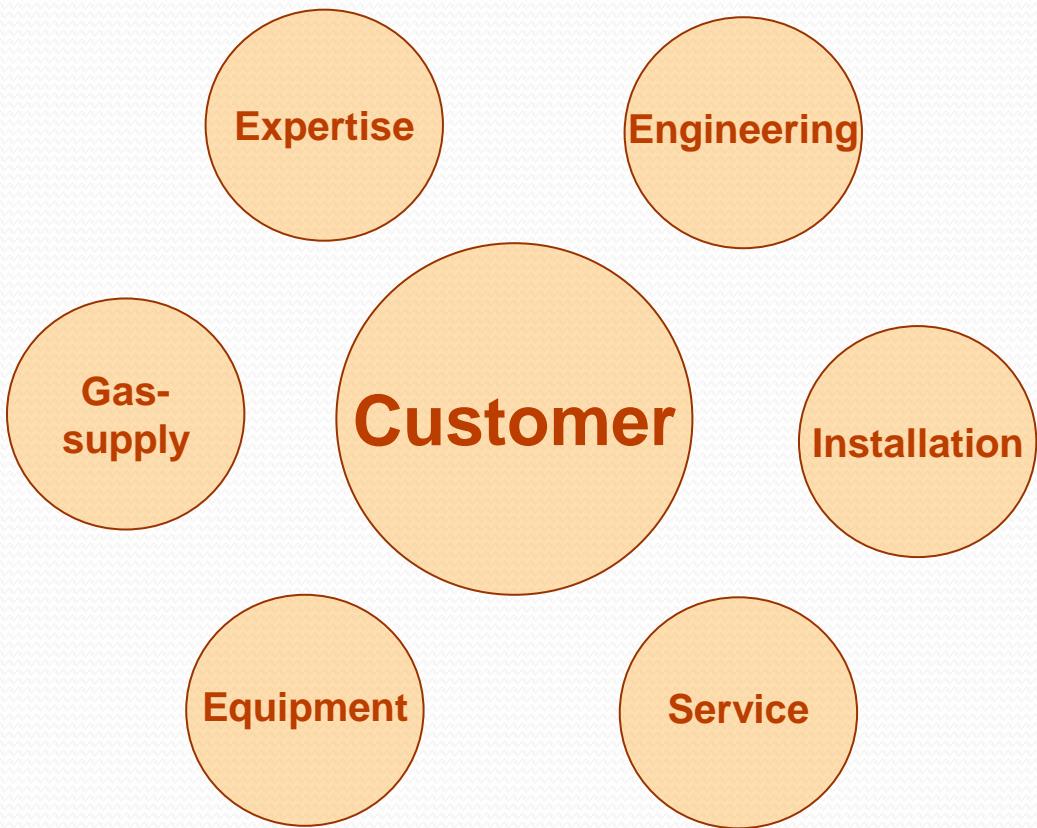
- Integration in existing systems
- Small space necessary
- Compact Design
- Simple installation



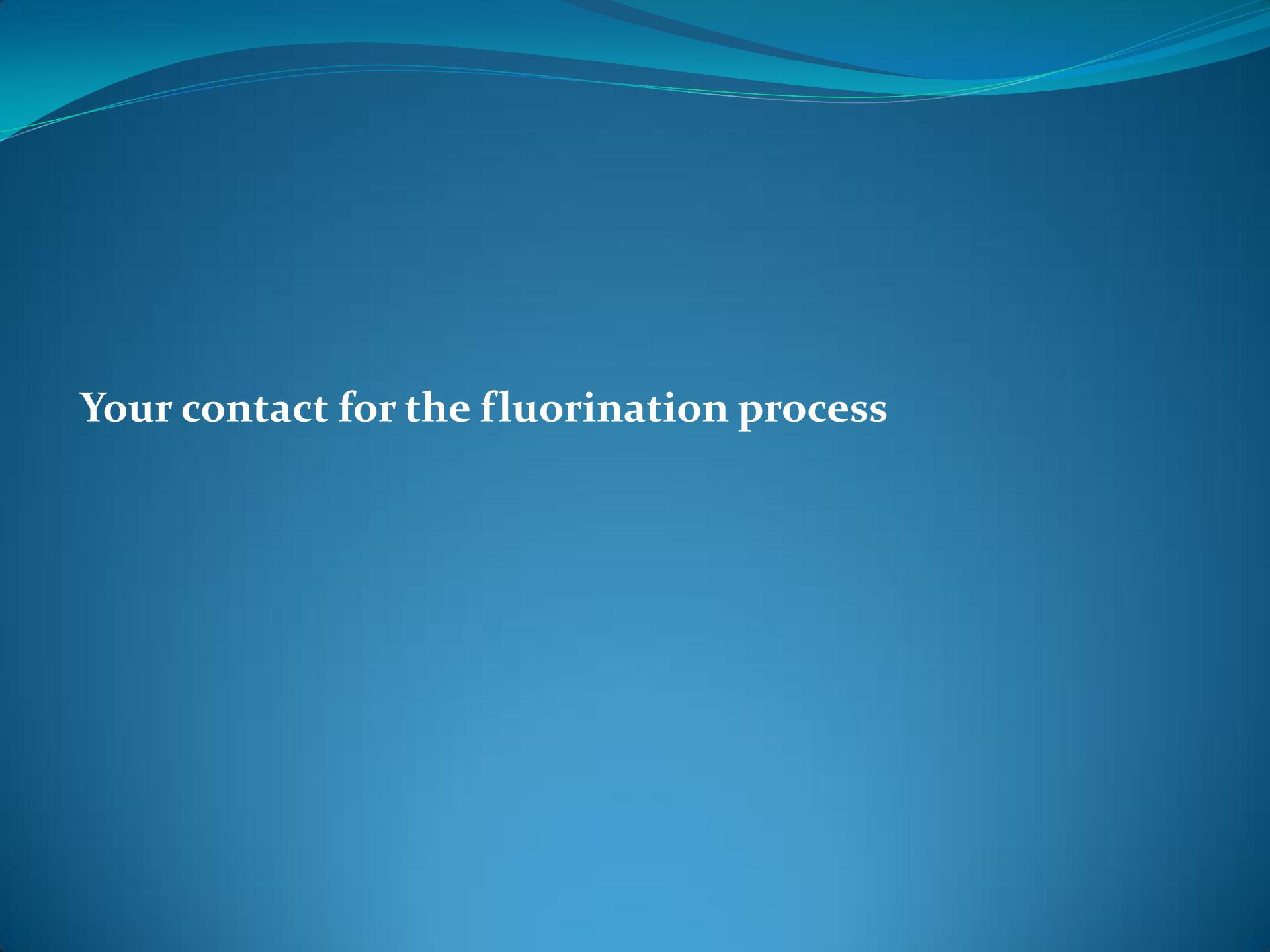
The background of the slide features a dark blue gradient. Overlaid on this are several thin, light blue wavy lines that curve across the top and right side of the frame.

All from one Hand..... worldwide

All from one Hand...



...worldwide



Your contact for the fluorination process

Your Partner for the all questions in case of fluorination

➤ **Woltering Verfahrenstechnik, Ochtrup**

- 20 years in systems engineering of the fluorination working
- Partner for our worldwide activities:
- **since 2011 working as Contract Fluorination Partner**
- Kontakt:
 - www.Woltering-Verfahrenstechnik.de

**Thank you for your
intention**



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I will tell you more

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