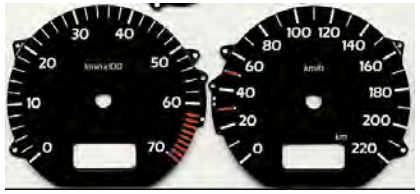
UV Excimer: Latest Developments

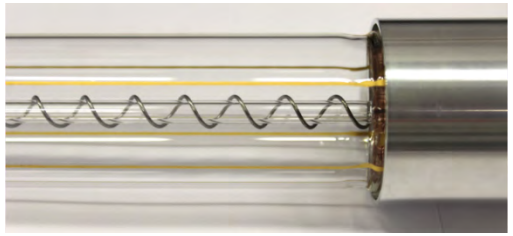
What is common?

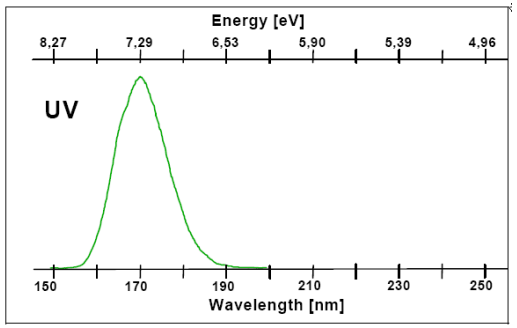


Pictures only show examples

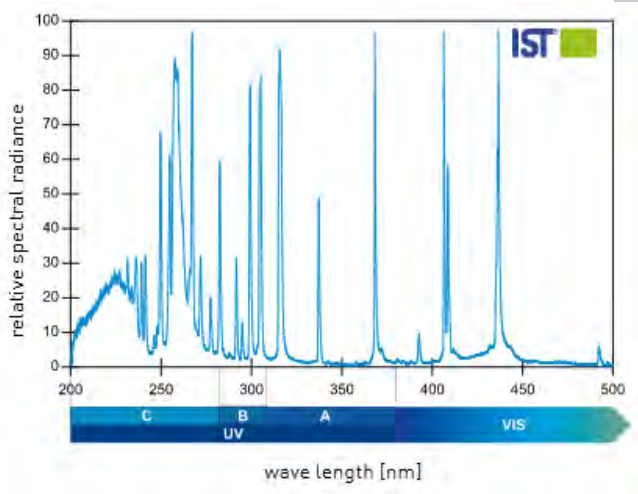
UV Light sources

Excimer



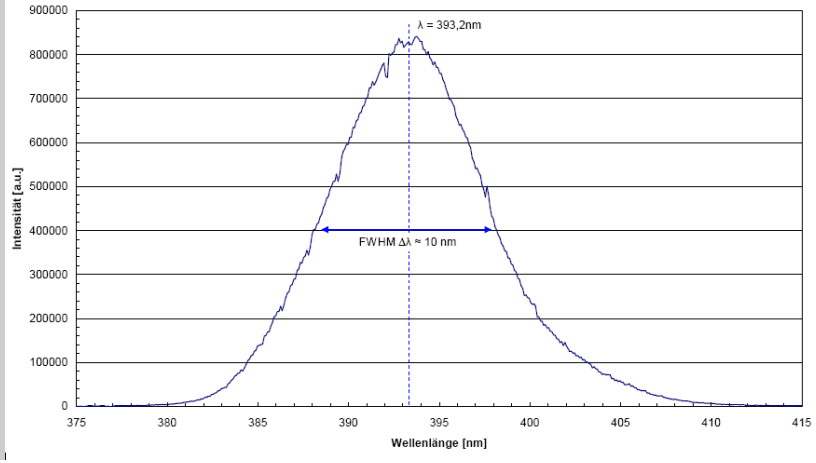


MP Mecury Lamp

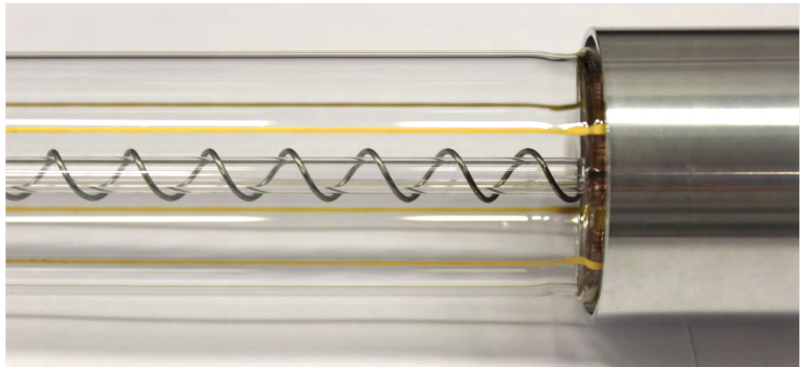


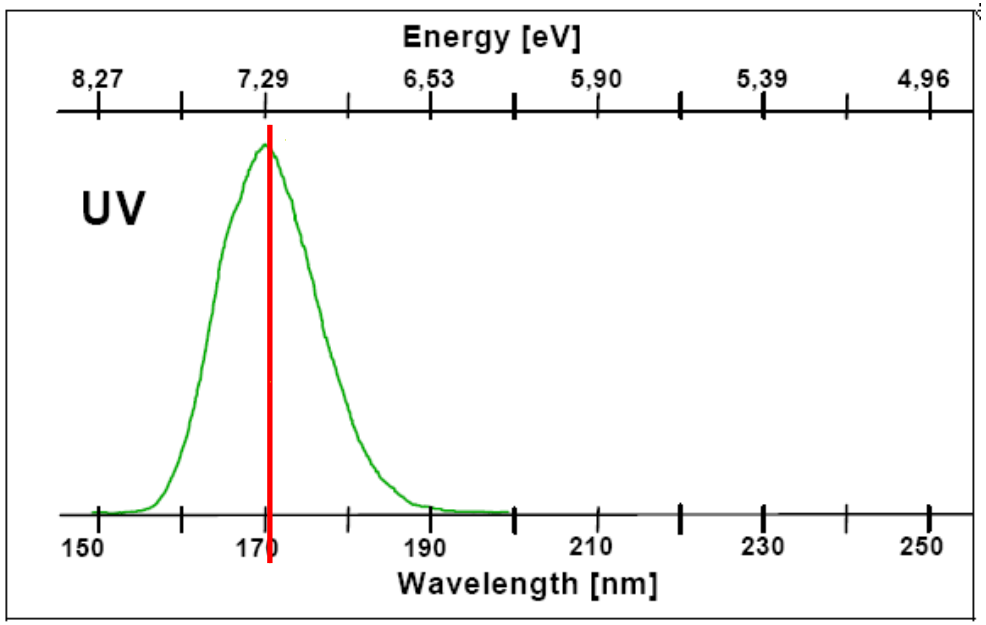
UV LED

Spektralmessung LUV @ 395nm



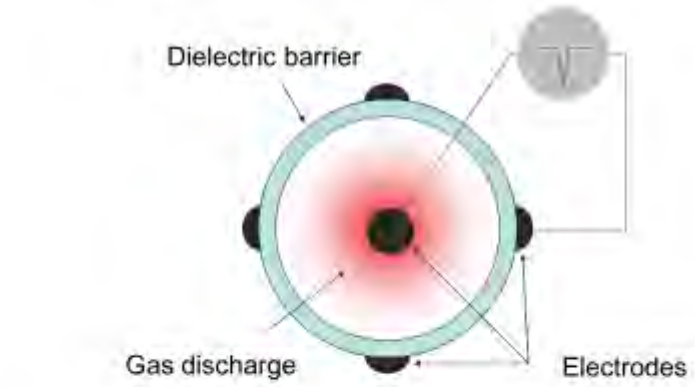
Excimer – Adapted UV Spectrum



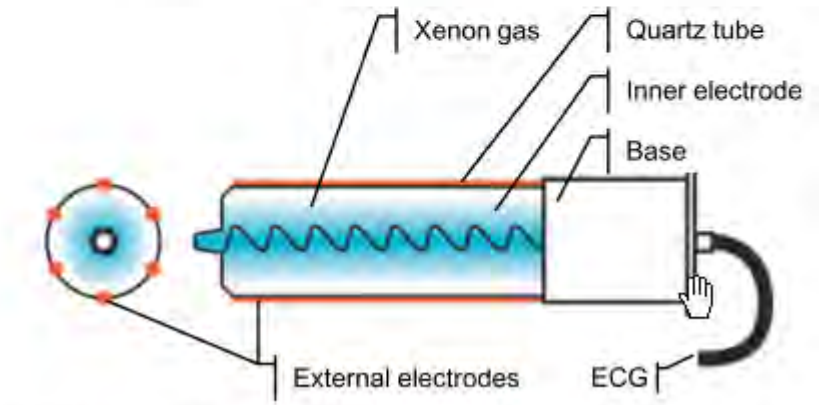


- Lamp lengtht: 120 mm – 2300 mm
- Power: Approx. 5W/cm, max. 1 KW, 20-100% power adjustment
- Efficiency: approx. 40%
- FWHM: approx. 14 nm
- Homogenity over lamp length: >95%
- Energy loss: 40 mm on each side

Excimer – Adapted UV spectrum



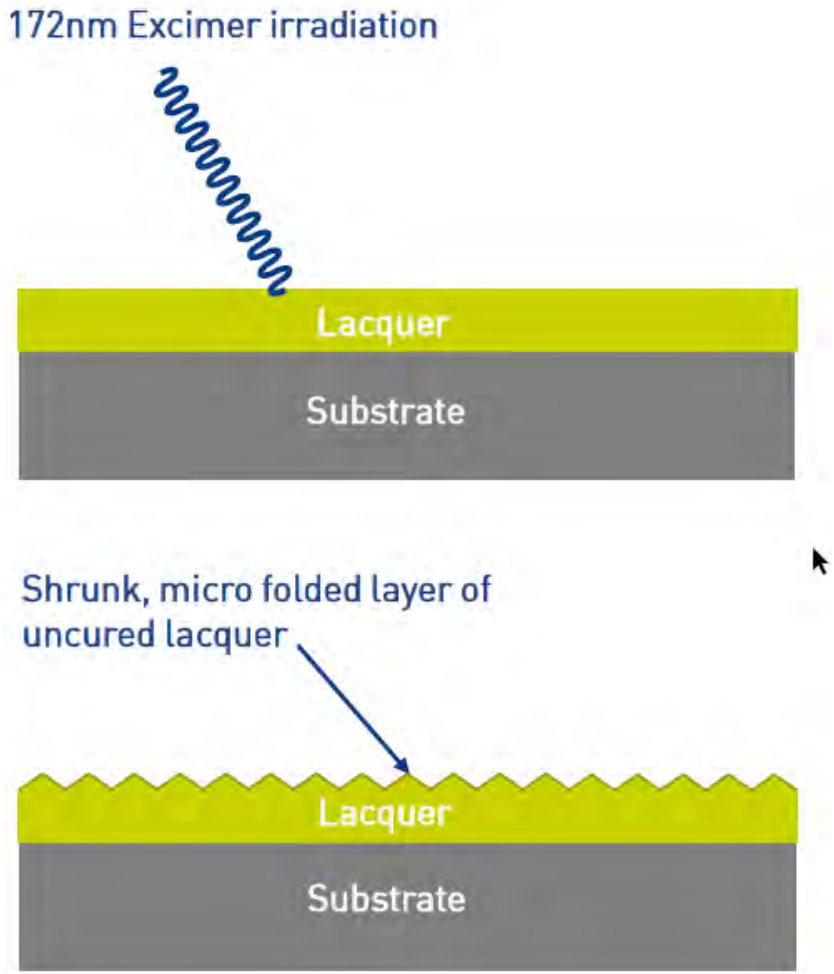
Principle setup of XERADEX® lamps.



Principle setup of XERADEX® lamps.

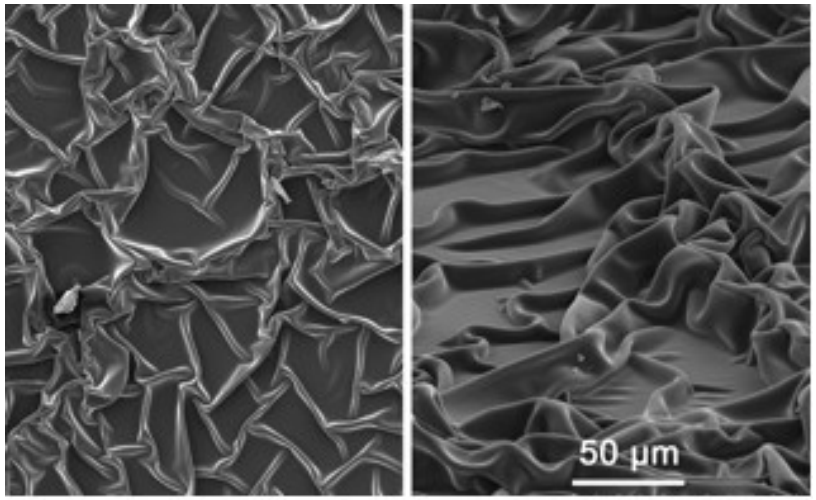
- Dielectric barrier discharge (DBD) reaction with quarz bulb as a dielectric barrier and the gas filling as discharge medium.
- Cooling needed for power levels at 5 W/cm.
- No cooling needed for lower power levels < 2 W/cm.

Application – Matting Application

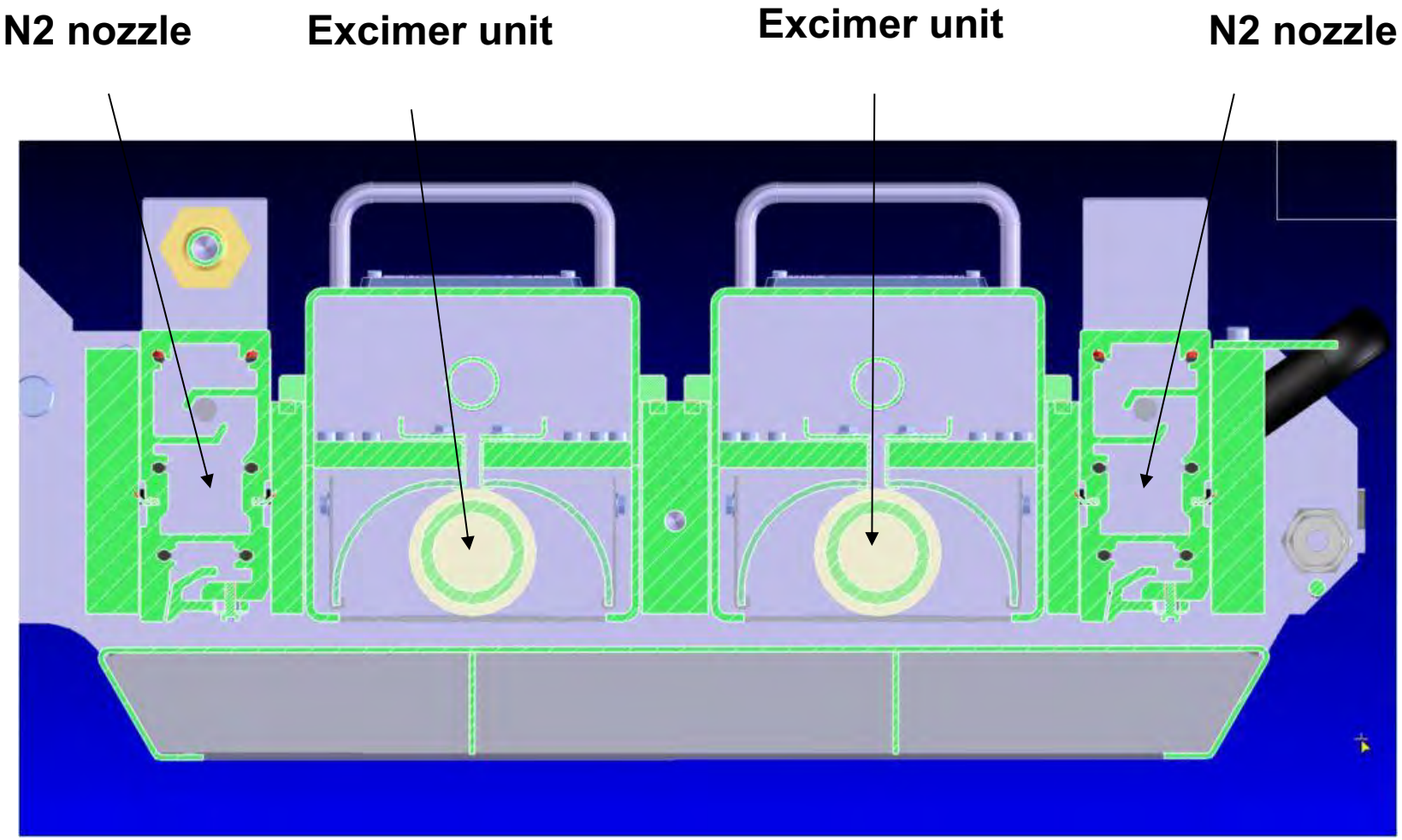


Application – Matting

- Alternative: pre-gelation for pigmented coatings or thick clear coatings
- Matting: UV-Excimer (172 nm) in inerted atmosphere
- Curing: UV medium pressure lamp (full spectrum) in inerted atmosphere
- No matting agents needed.
- Gloss level:
  - Wood Foil: 2-3 gloss units
  - PVC: 5-10 gloss units



UV Excimer (for creating matt effects)

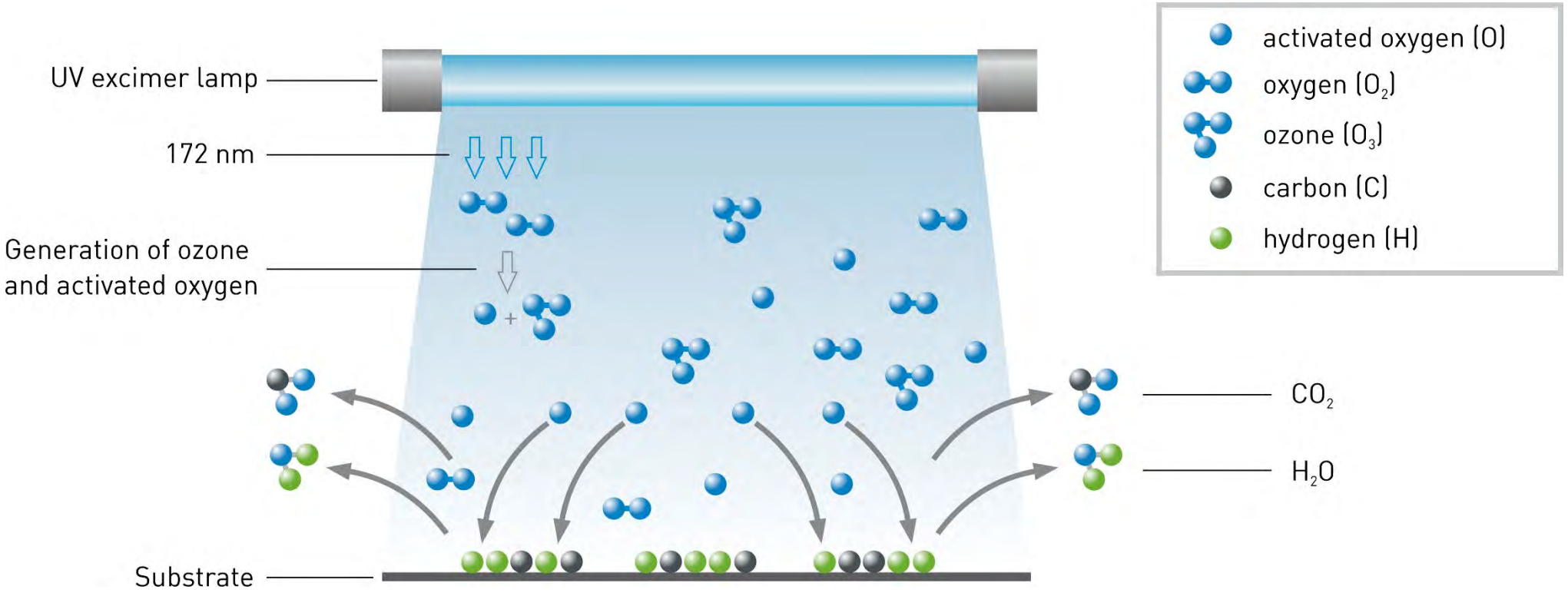


Nitrogen flow over nozzles and Excimer lamps

UV Excimer (for matt effects)

Application: UV-Cleaning - Principle

- **Concept of optical cleaning**



Application: UV Cleaning - Basics

Energy of excimer 172 nm:

→ 7,2 eV
→ 695 kJ/mol

Energie	eV	kJ / mol	kcal / mol	cm^{-1}
1 eV	1	96,485	23,06	8065,5
1 kJ / mol	0,01036	1	0,239	83,593
1 kcal / mol	0,04336	4,184	1	349,76
1 cm^{-1}	$1{,}24 \cdot 10^{-4}$	0,01196	$2{,}859 \cdot 10^{-3}$	1

Abhängigkeit der mittleren Bindungsenergie von der Bindungslänge[2]

Bindungslänge *d* in pm, Bindungsenthalpie Δ*H* in kJ pro mol

Halogene untereinander		
Bindung	Δ*H*	*d*
F–F	159	142
Cl–Cl	242	199
Br–Br	193	228
I–I	151	267
Br–Cl	219	214
Br–F	249	176
Br–I	178	
Cl–F	253	163
Cl–I	211	232

mit Wasserstoff		
Bindung	Δ*H*	*d*
H–H	436	74
H–C	413	108
H–O	463	97
H–N	391	101
H–P	322	142
H–S	367	134
H–F	567	92
H–Cl	431	128
H–Br	366	141
H–I	298	160

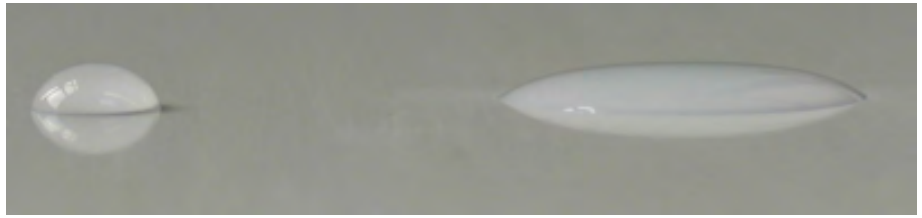
mit Kohlenstoff		
Bindung	Δ*H*	*d*
C–C	348	154
C=C	614	134
C≡C	839	120
C–H	413	108
C–O	358	143
C=O	745	122
C–N	305	147
C=N	615	130
C≡N	891	116
C–P	264	184
C–S	272	182
C=S	536	189
C–F	489	138
C–Cl	339	177
C–Br	285	194
C–I	218	214

mit Sauerstoff		
Bindung	Δ*H*	*d*
N=O	607	
O–N	201	136
O–P	335	154
O–F	193	142
O–Cl	208	170
O–Br	234	
O–I	234	1

gleiches Element		
Bindung	Δ*H*	*d*
H–H	436	74
N–N	163	146
N=N	418	125
N≡N	945	110
O–O	146	148
O=O	498	121
P–P	172	221
S–S	255	205

Conclusion for UV cleaning

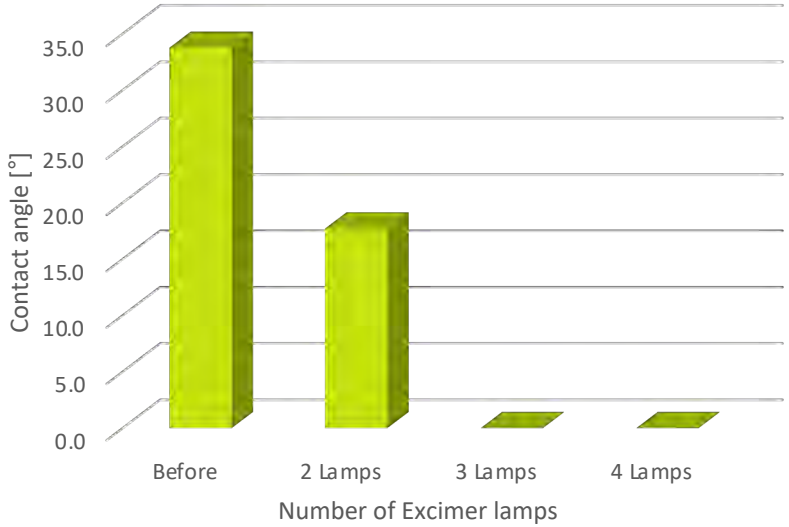
Reduction of contact angle will be improved



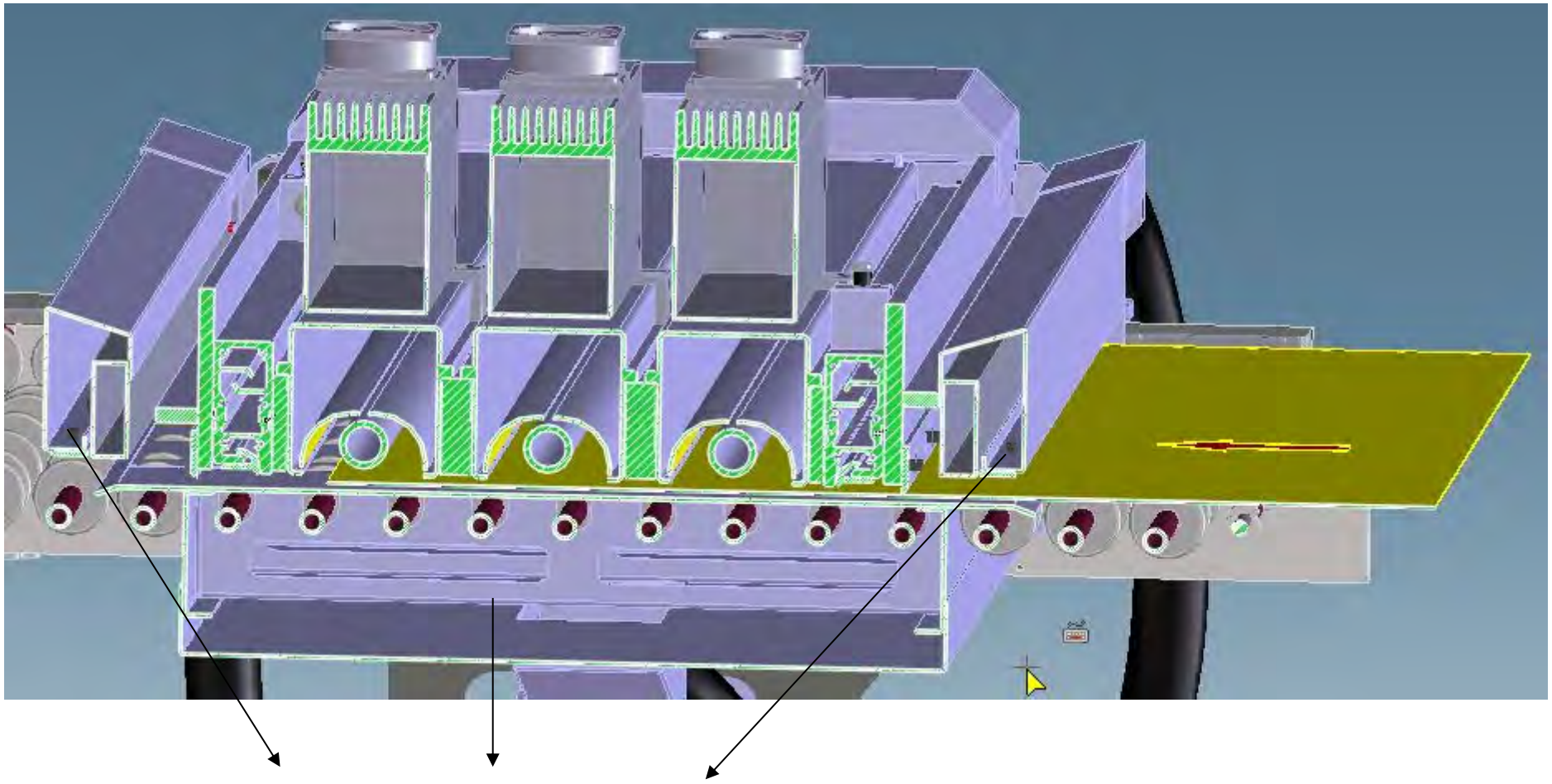
- Optimum concentration of activated oxygen
- Low distance from lamp to glass
- High UV dose

For UV cleaning:

- Small gas flow necessary to evacuate contaminents.
- Overlapping of lamps has to be considered
- Cleaning effect causes on a combination of UV radiation and optimum oxygen concentration.

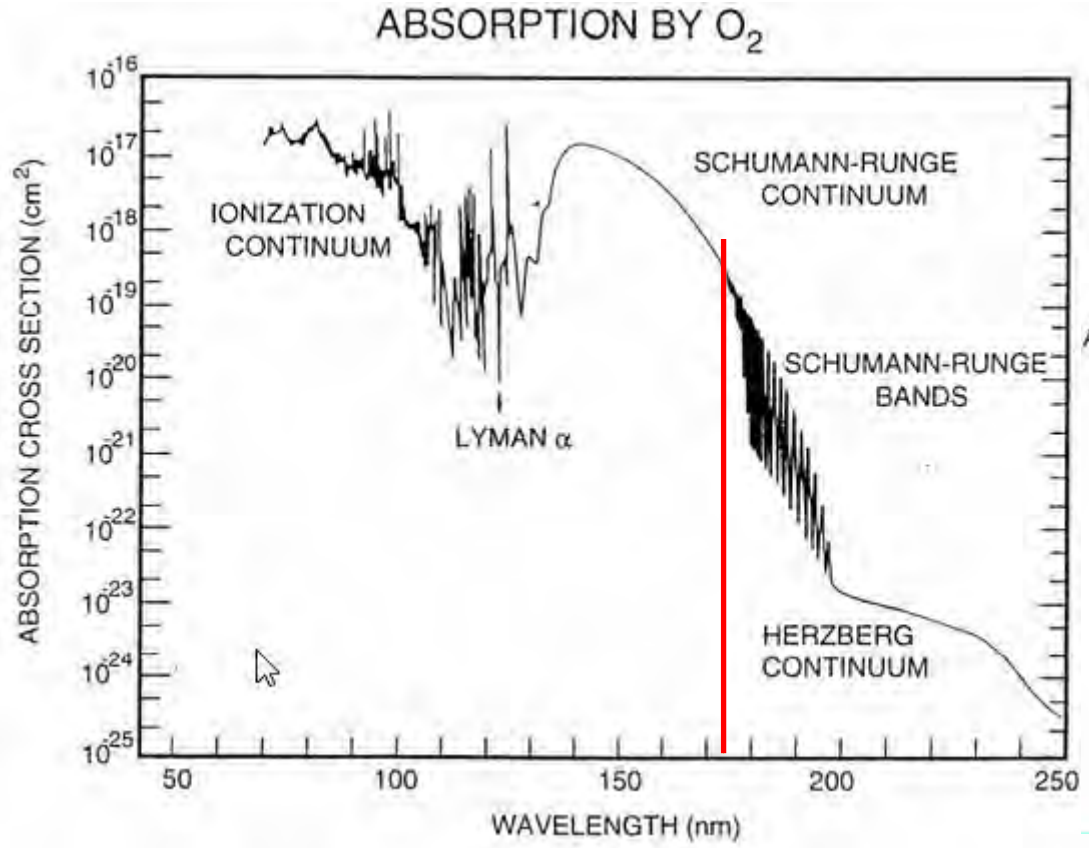


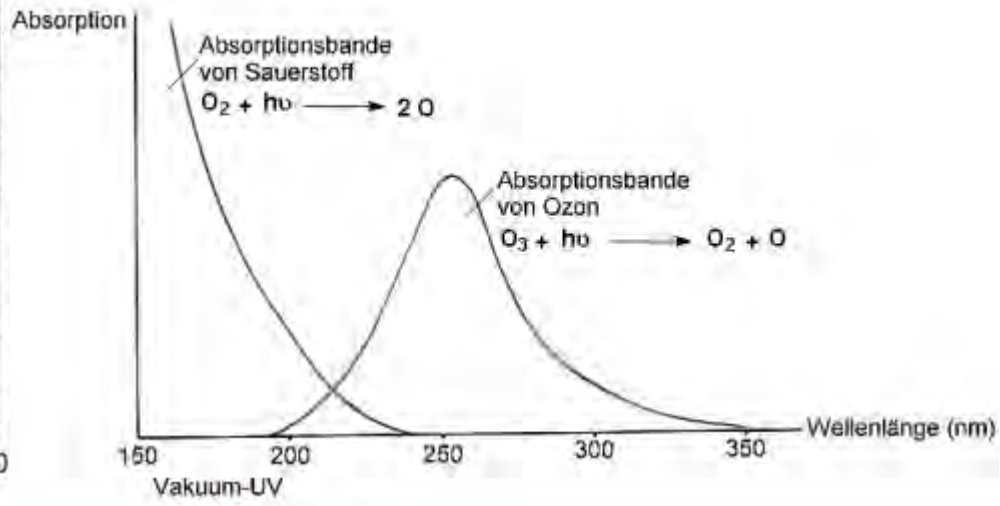
UV Excimer (for cleaning)



Additional: Gas removal channels

Why Inertisation?





Excimer – Oxygen /Ozone control

nitrogen supply

nitrogen supply

Gas flow

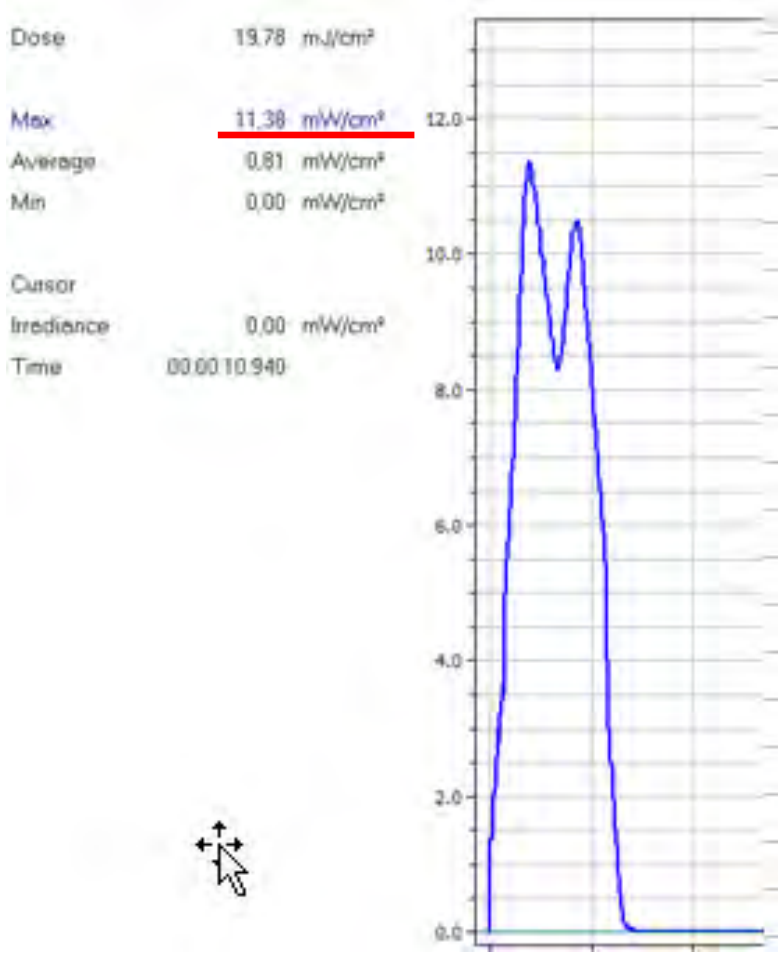
Ozone value or

Oxygen value

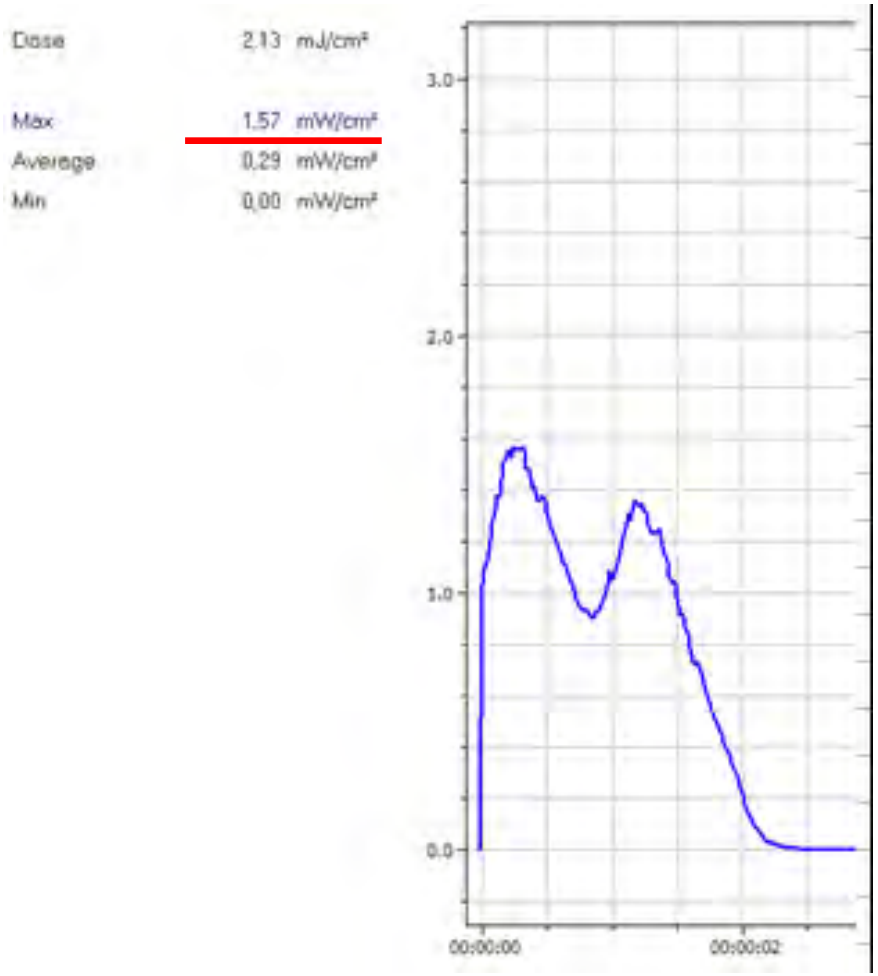
Valve control

Patent pending!

Excimer @ 1 mm distance



30 ppm O_2



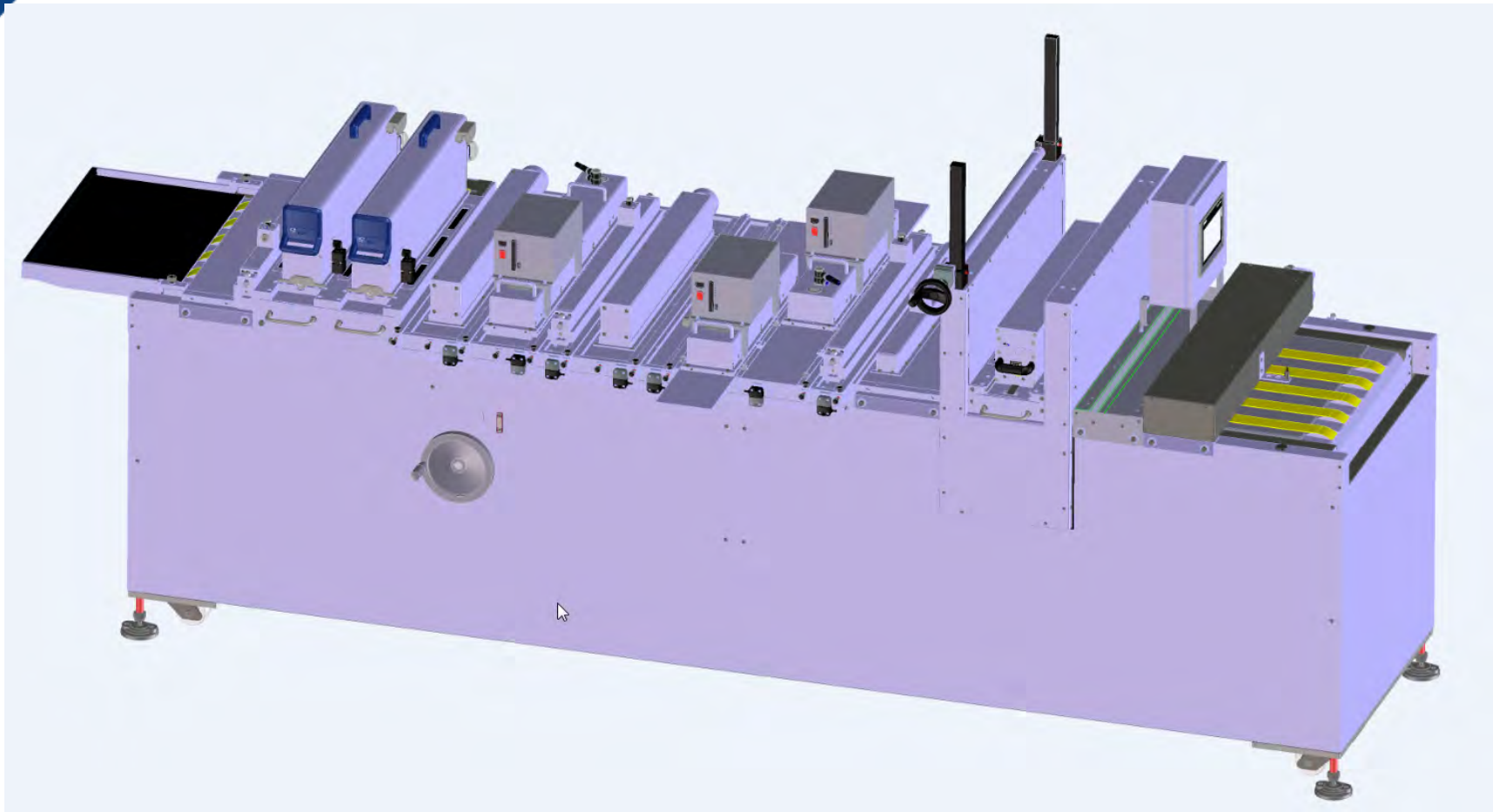
500 ppm O_2

Excimer – Matting / Cleaning version

- **Matting Version:**
  - Inerted version
  - Oxygen measurement and control
  - Approx. 350 ppm O2
  - Passive dust collecting channel at outlet
  - High uniformity
- **Cleaning Version**
  - Inerted version
  - Ozone measurement and control
  - Approx. 100-2000 ppm O2
  - Active gas extraction (Ozone)
  - High power
  - N2 conditioner

-> application specific system design

Excimer Lab System - Example



Thanks for your attention