



Hybrid Radiation Curing – UV, LED and Excimer

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IST METZ – Introduction



- IST METZ GmbH, Nürtingen, Germany
→ „Made in Germany“
- Founded in year 1977
- Market leader with over 13,000 UV installations Worldwide
- Approx. 350 (IST METZ)
- Approx. 600 (IST METZ Group)
- 14 Subsidiaries around the World.

IST – Product Snapshot – ENERGY IN LIGHT

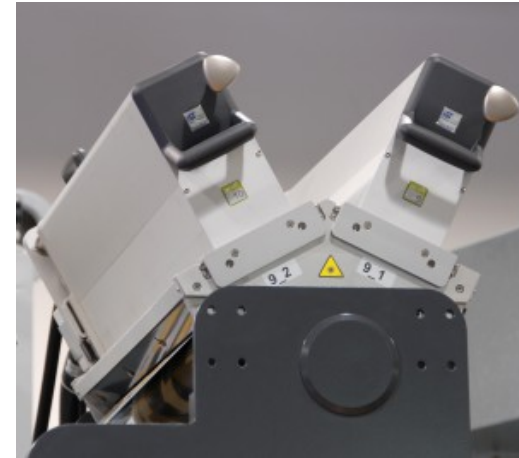
Water and Air-cooled UV Lamps

Water and Air-cooled LED Systems

Excimer systems

IR Systems

Combination of ALL the above



Examples of Radiation Curing Applications

- Technical Coatings
- Inks
- Adhesives
- Composites
- Silicone/Release
- Cleaning
- Combi Curing Systems ... UV/LED/IR/Excimer

UV & LED Fields of Application - Examples

Graphic Arts Industry

- Offset
- Rotogravure
- Flexo
- Screen printing
- Pad printing
- Inkjet
- Letterpress



Converting

- Optical Functional Films
- Displays
- Siliconization
- Hotmelt-PSA
- PVC flooring
- Lamination of webs and plastics
- Scratch resistant coating of films



Industrial Applications

- Automotive parts
- UV PVD processes
- Cosmetic industry
- Anti-corrosion on metal
- Adhesives & Encapsulations
- UV Pretreatment & cleaning
- Furniture & flooring
- Telecommunication
- Coil Coating
- Composites
- Electronics
- Industrial Inkjet
- Rapid Prototyping
- Air & Water treatment
- Cups, tubes and cans (RIM)



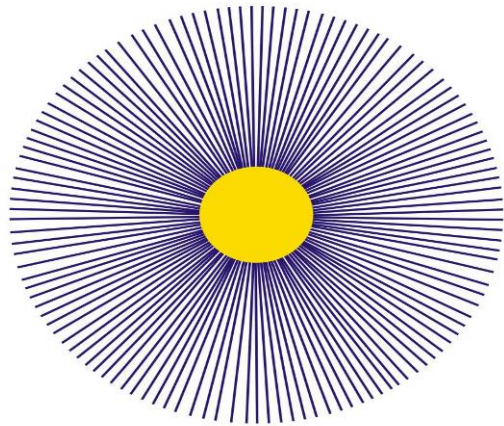
Traditional UV Curing – Typical in Industrial Application

- Typical water-cooled UV lamp – output determined by bulb dopant and reflector.
- Typical widths between 10“ to 96“
- Different variations of mounting solutions.
- Integrated UV measuring
- Inertisation common (N₂)
- Closed loop power control for precise curing.

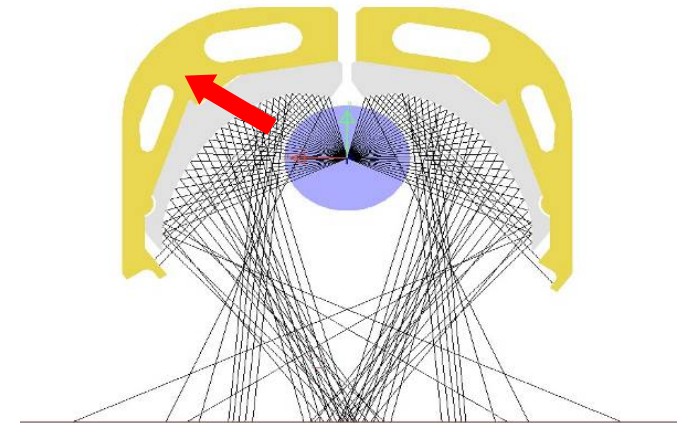
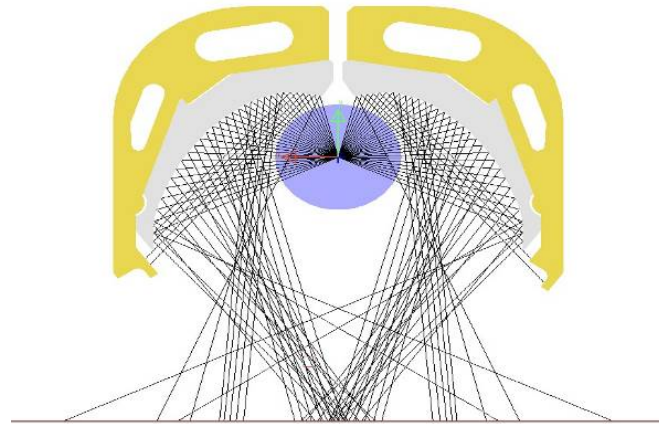


Traditional UV Curing – Focus and Distance

... is about how to guide the UV light from the UV lamp to the substrate.

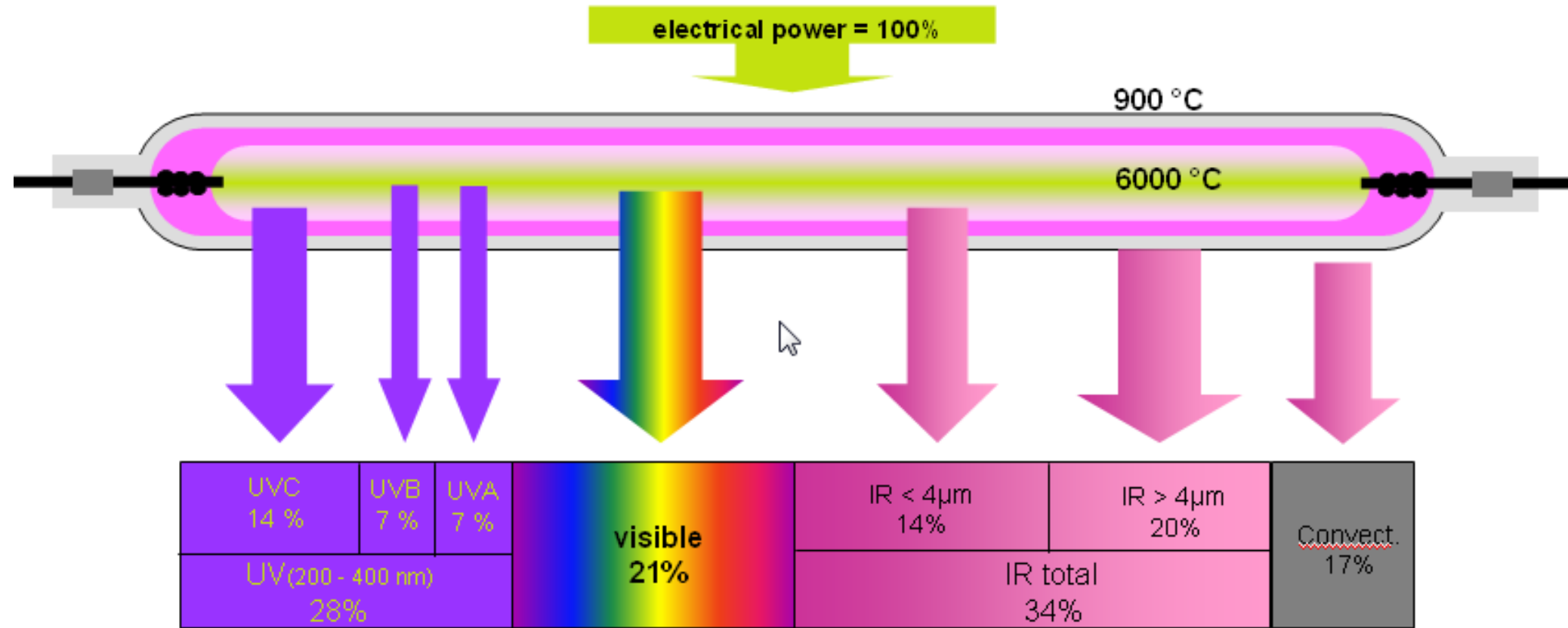


No reflector = more than 50%
loss of UV light



Heat removal for heat sensitive
substrates
-> Cold Reflector

UV Output - Dopant

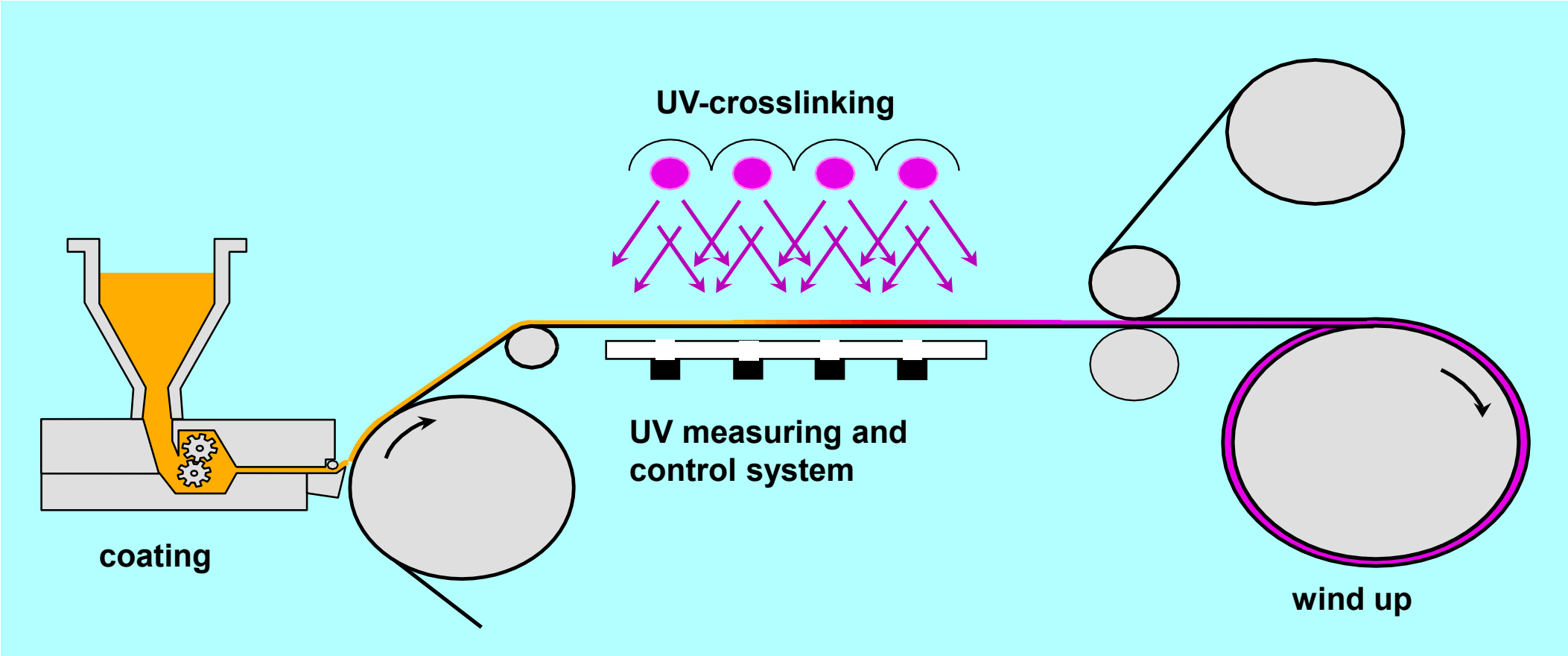


Typical characteristics for standard Hg lamp according to [Lambrecht 1999]

Dose & Intensity – KEY Parameters in UV Curing

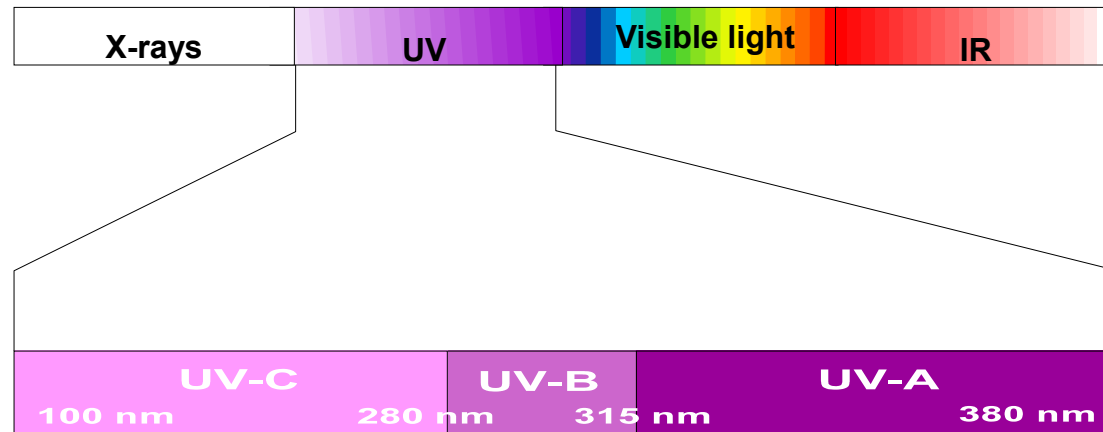
- Intensity (Peak) in mW/cm^2
- Dose (energy density) in mJ/cm^2
- Both are defined in UVC, UVB and UVA ... and Dose has a velocity value given.
- Both can be measured with a radiometer (EIT Power Puck).
- Type of reaction – free radical or cationic will also define your UV system configuration.
- UV Output is **NOT** measured in Watts/inch ... this is INPUT!!!

UV Application Example – UV Acrylates -> Tapes



LED – UVA Alternative

- **Active UV Band**
 - **UVC** – Short Wavelength, high energy ... creates surface characteristics
 - **UVA** – Opaque/pigmented coatings, long wavelength with better penetration.

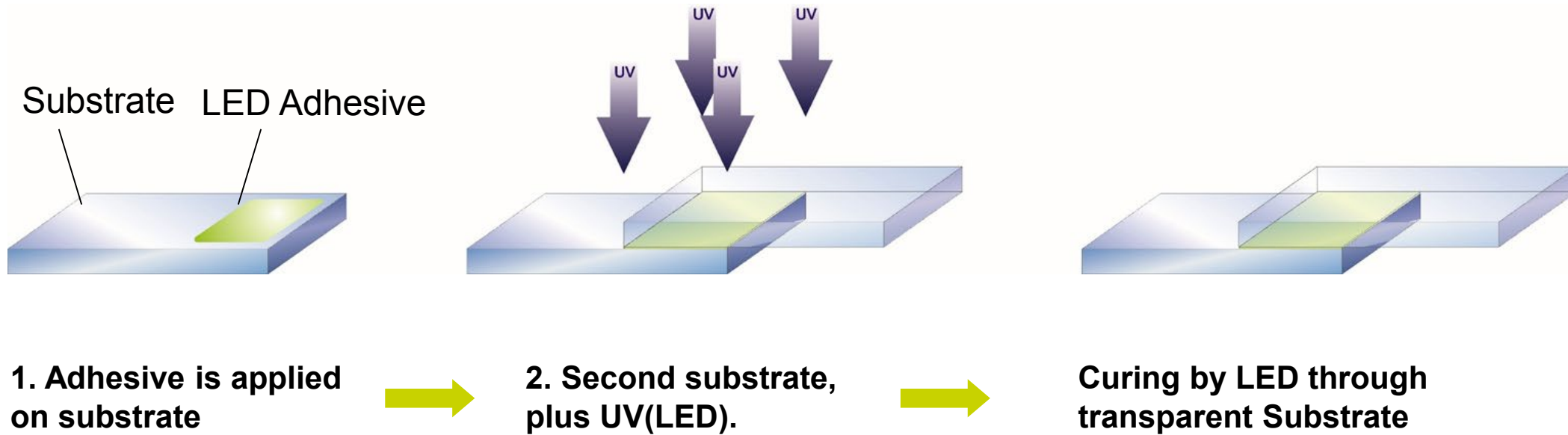


LED – UVA Alternative



- **LED is monochromatic (steep bell curve) with no IR content web facing.**
- **UV alternative formulations are being developed**
- **Less energy costs.**
- **Smaller footprint.**
- **Immediate cycle times ... No warm up.**
- **When comparing with UV, ROI needs to be carefully reviewed.**
- **Hybrid UV/LED/Excimer available.**

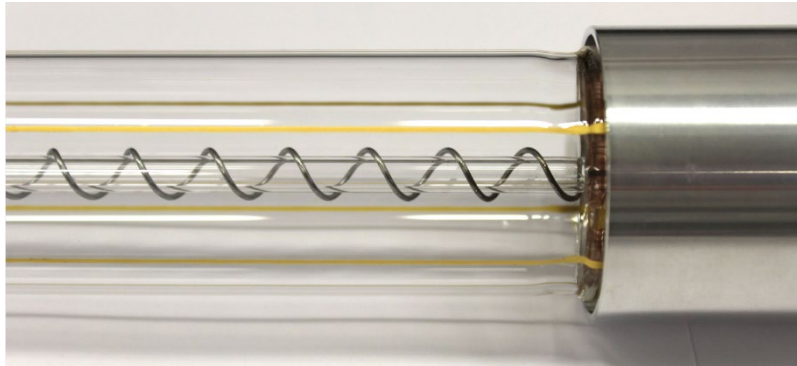
LED – Application Example -> Adhesive



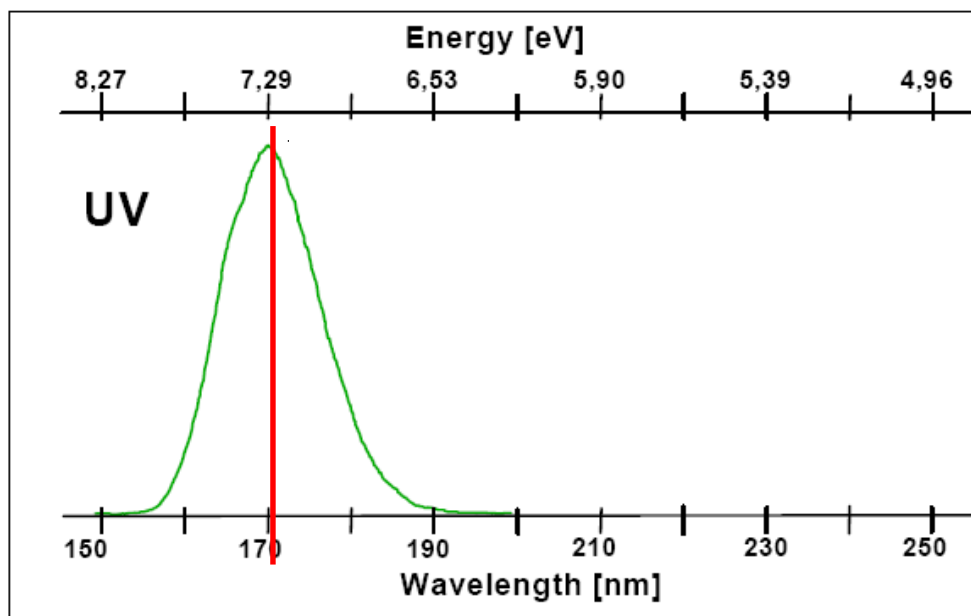
Dose & Intensity – KEY Parameters in LED Curing

- Intensity (Peak) in mW/cm^2 ... this is measured at the emitting window
- Dose (energy density) in mJ/cm^2 ... size of window has an effect.
- Both can be measured with a radiometer (EIT Power Puck)... configured for LED.

Excimer Technology – 172 nm

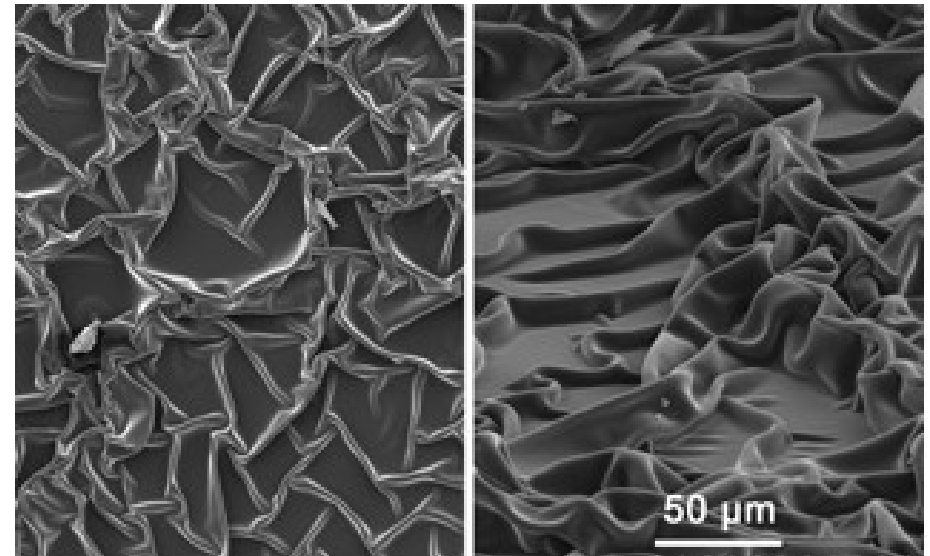


- Lamp lengths 375 – 2300mm
- Power output 5W/cm -> 1 kW
- Homogeneity over lamp length > 95%

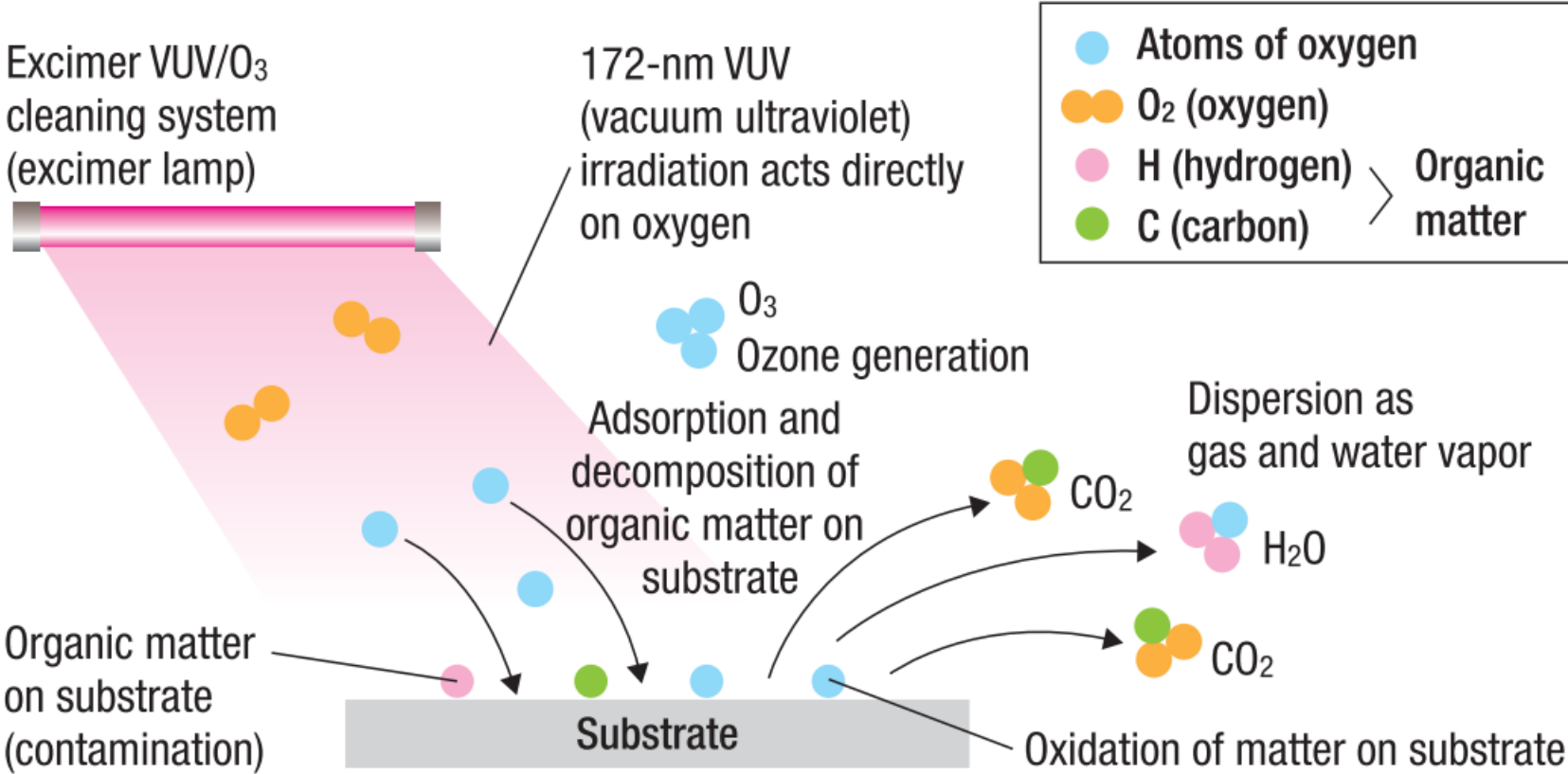


Excimer Application – Matt Coatings

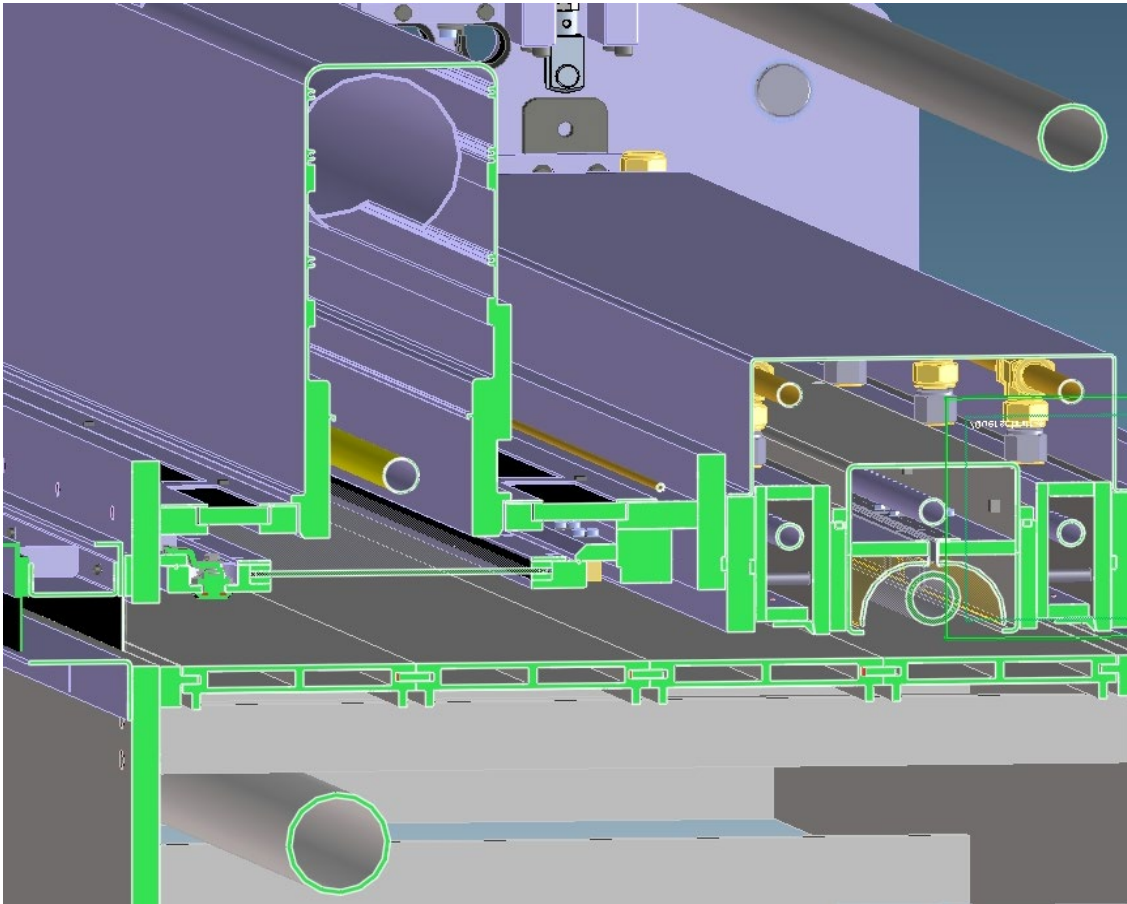
- Pre-curing: UV Excimer (172 nm) in inerted atmosphere
- Curing: UV medium pressure lamp (full spectrum) in inerted atmosphere (N₂)
- No matting agents needed.
- Gloss level: < 5 gloss units



Excimer Application - Cleaning



Hybrid Platform – Application Example: Tacho Discs.



- Combination of excimer and UV
- Possible to add LED

Hybrid Technology Platform

- ❑ Basic principle – combining the best properties of energy and output.

- ❑ In summary:
 - UV – Broadband output, dopant determines band emphasis (UVC, UVB, UVA). Complex system with heat load. High output at distance.

 - LED – Monochromatic output in UVA, no heat or ozone. Simple set-up. Lacks energy for surface cure. Good for through cure.

 - Excimer – 172 nm only. High energy output (7.2 eV!). Requires N₂. Offers alternative to complex and expensive formulation/chemistry. Also offers surface modification capability. Material needs to be close to lamp.

Process Evaluation & Application Know-How

- Process evaluation – technical compatibility.
- Develop and advise new applications and technologies – Resources???
 - Process knowledge transfer ... Training, workshops, tribal knowledge exchange, lab trials, material qualification and cure capacity, etc.
- Application equipment, production line (NEW OR EXISTING), UV/LED/Excimer requirements ...
- Capex and Opex, multiple factors.
- Transition of materials, formulation, personnel CULTURE!!!!

... And Finally ...

- ❖ Over forty years of Industrial Experience with radiation curing applications and chemistries
- ❖ In-house Lab with IST Specialists available for development and application trials
- ❖ Develop and advise new applications and technologies
 - Wide selection of UV and LED types, as well as HYBRID.
- ❖ Associations, collaborations and partnerships throughout industry and academia – Access to Knowledge!
- ❖ Process evaluation
- ❖ Long term technology partner



Thank you for your attention and interest!

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