

World's Smallest VUV Excimer Pen-type Lamp

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Overview

- Introduction to Hamamatsu Photonics
- Ex-PEN
 - Specifications
 - Applications

Hamamatsu Photonics: A Driver in the Industry

"A HIDDEN CHAMPION OF THE 21TH CENTURY"

Hermann Simon, author of the *Hidden Champions of the Twenty-First Century*



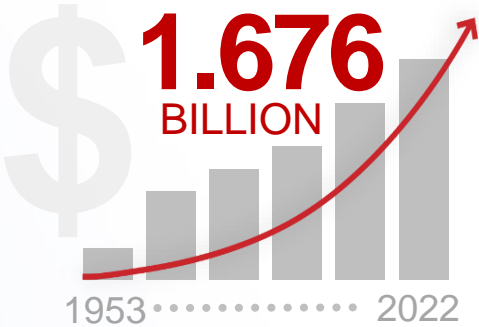
SINCE
1953



10
RESEARCH &
PRODUCTION
BASES



5,491
EMPLOYEES

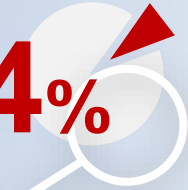


3 NOBEL
PRIZE
CONTRIBUTIONS



15,000
PRODUCTS

5.4%
R&D
EXPENSE



1995
ENTRY IN
TOKYO
STOCK EXCHANGE

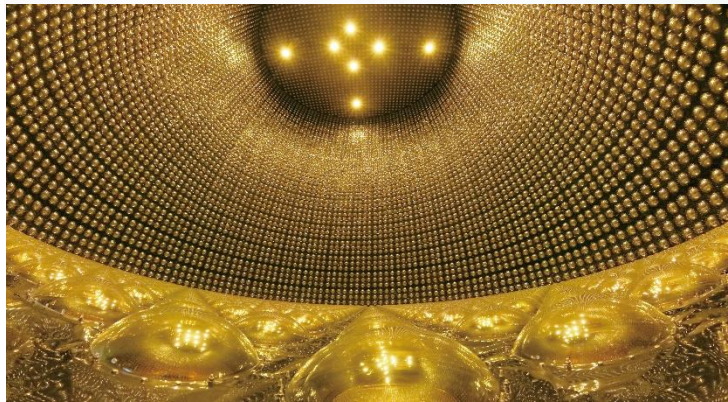


UNITED NATIONS
GLOBAL COMPACT

- ✓ HUMAN RIGHTS
- ✓ LABOUR STANDARDS
- ✓ ENVIRONMENT
- ✓ ANTI-CORRUPTION

*Figures taken in 2021/2022

Technological know-how: 70 years of expertise



Detectors

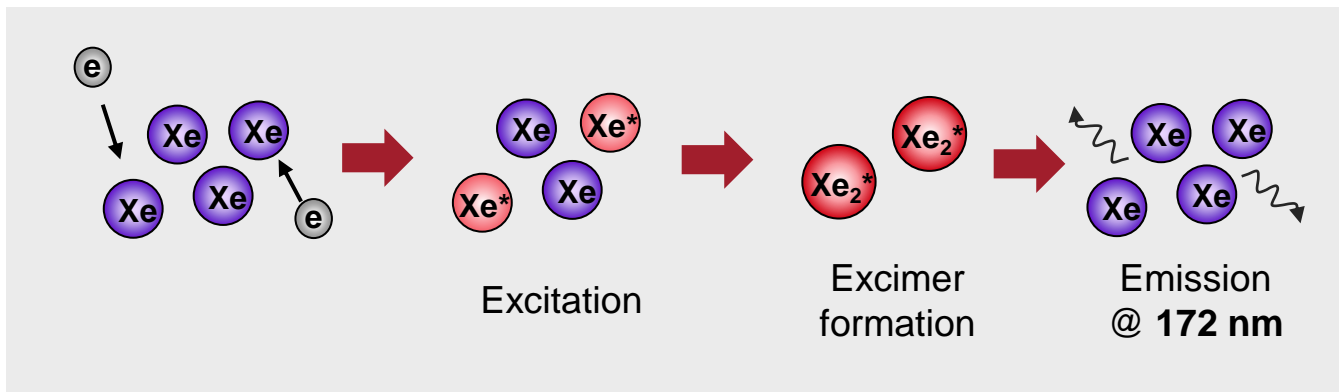
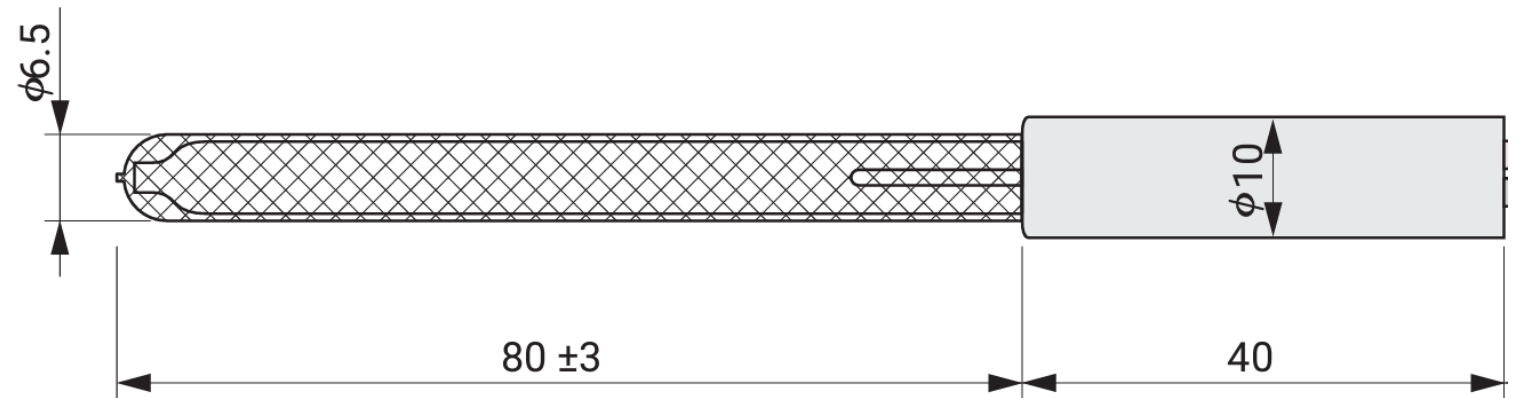
**Vacuum Tube
Technology
+
Optoelectronics**



Light sources

Excimer Pen (EX-PEN)

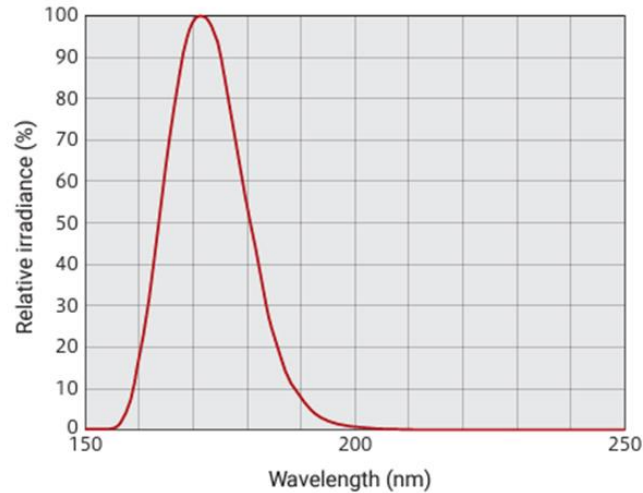
Excimer Pen (EX-PEN)



Excimer (Excited Dimer) emission

- Vacuum UV (VUV) wavelengths < 200 nm
- EX-PEN is a VUV lamp
- Just 6.5 mm in diameter and 80 mm in length

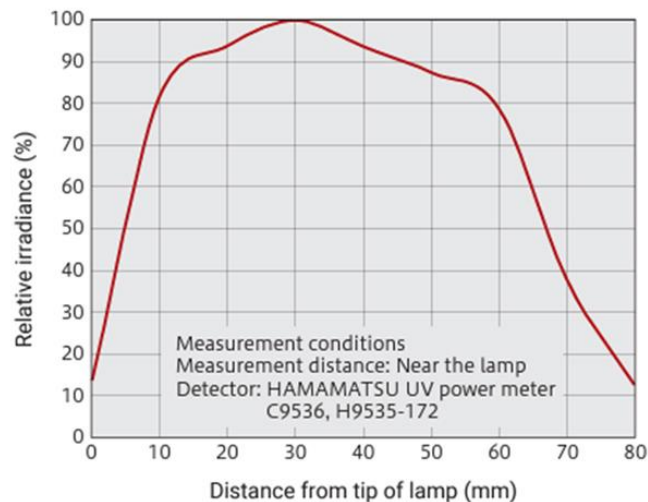
Spectral distribution (Typ.)



Product features

- Quasi monochromatic
- Low-temperature operation (no cooling required)
- Mercury-free
- UV irradiance $\sim 7 \text{ mW/cm}^2$
- Lifetime $\sim 2000 \text{ h}$ (50% drop)

Irradiance distribution (Typ.)



VUV emission

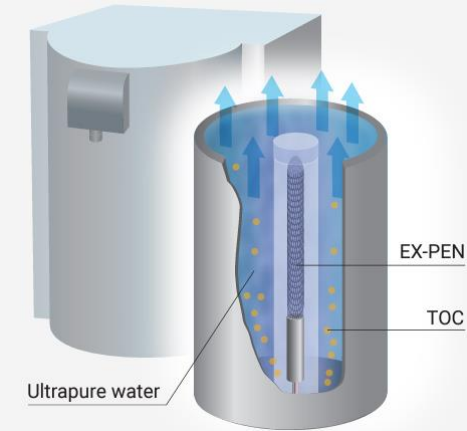
- $172 \text{ nm} = 7.2 \text{ eV}$
- Bonds weaker than 7.2 eV can be cleaved !
- Examples: C-C, C-F, C-Cl, F-F, Cl-Cl, Br-Br, I-I, H-H, H-F, O-H, O-H, O-H, O=CH₂, O=O,
- Resistant bonds: N \equiv N, O=CO, C \equiv O

Source: [Wikipedia](#)

Applications

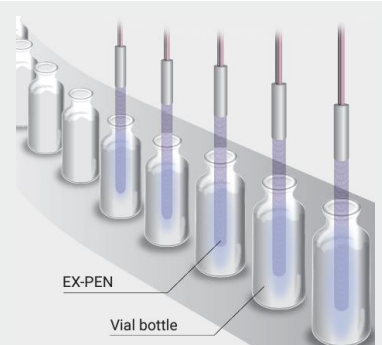
Oxidation of organic compounds

- Water quality analysis:
 - Total Organic Content (TOC) is a measure of unwanted organic content in water.
- Removal of harmful chemicals
 - Volatile Organic Compounds (VOCs) are common air pollutants from industries¹



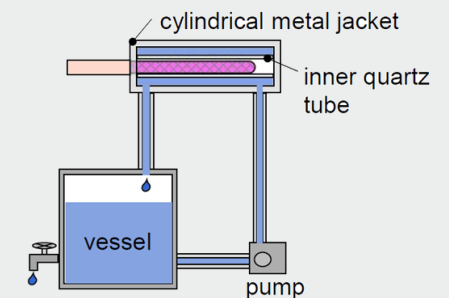
Surface modification

- Increases wettability
- Improves chemical resistance and mechanical resistance of coatings



Water purification systems

- VUV oxidation
- Small form factor → bench top systems



1. <https://www.sciencedirect.com/science/article/abs/pii/S0045653522031496#!>

Competition & Conclusions

	Hg low pressure lamps	EX-PEN
Spectral distribution	Multispectral	Quasi monochromatic
Hazardous materials	Yes	No
Switch On/Off speeds	Slow (need warm up time)	Instant On/Off
Form factor	> 10 mm dia	Just 6.5 mm in dia
Thermal management	Hot to handle	Not hot to touch
Power Output	Lower	7 mW/cm ²

So, to sum up

EX-PEN is an environmentally friendly VUV lamp with fast response, high power, and a form factor which enables easy integration

Thank you!



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