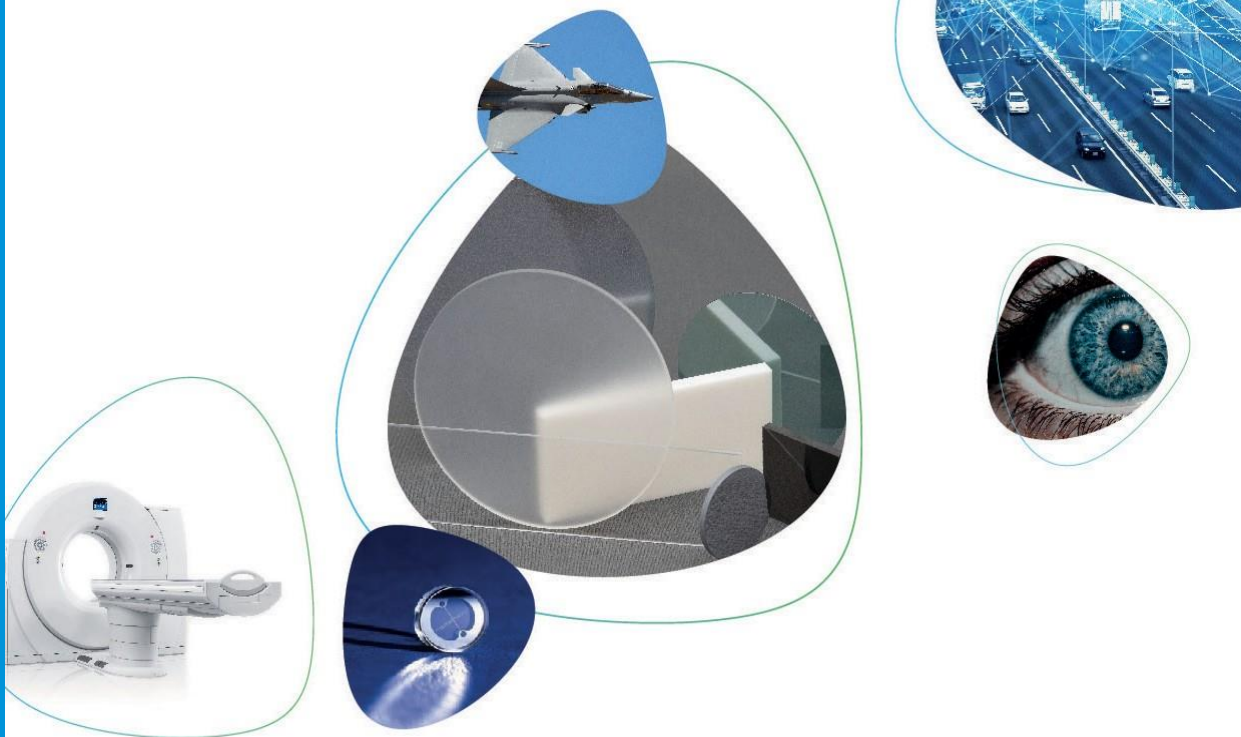


KERDRY  
HEF<sup>®</sup>PHOTONICS



# ***Conductive Anti-Reflected coatings for shielding in harsh environments***

*«To be an actor of progress by transforming science into industry in a free and pioneering company.»*

 **HEF<sup>®</sup>**  
PHOTONICS  
SURFACE MATERIALS ENGINEERING

*Jorge Juliàn Sánchez Martínez*  
*Sales & Bus. Development Senior*

 **HEF<sup>®</sup>** GROUPE

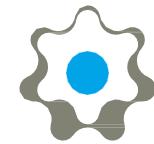
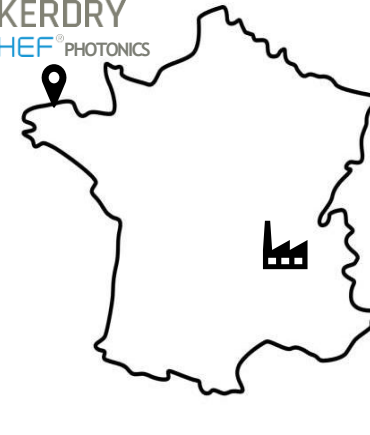
- **Group HEF/KERDRY**
- **KERDRY at glance**
- **ITO technical introduction**
- **Our proposal**

# CUSTOM DESIGNED METALLIC AND OPTICAL COATING FOR ADVANCED TECHNOLOGIES

- KERDRY, custom thin film coating for advanced technologies.
  - From R&D to mass production
  - Wide range of markets : space, defense, metrology, photonics...
- Since 2003, KERDRY has created an industrial tool adapted to optical and metallic treatments by thin film deposition under high vacuum and in controlled environment.
- More than 15 PVD machines is installed in more than 1000 m<sup>2</sup> of clean rooms (ISO 5 to 7). 35 chambers in the group.
- Optical treatments from UV to IR (anti-reflection, mirror, intense black, dichroic, filter...)
- Capacity up-to 1.40 m (55') substrate diameter
- Photolithography (up to 8 inch.), res. ~1 micr.

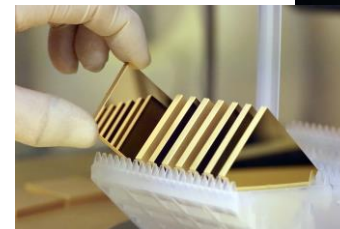


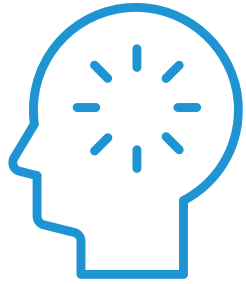
KERDRY  
HEF<sup>®</sup> PHOTONICS



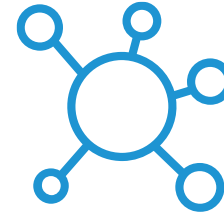
HEF<sup>®</sup>  
PHOTONICS

SURFACE MATERIALS ENGINEERING





Creation **1953**



Innovative corporate **social** model



**86** industrial plants in  
**21** countries



**Global** footprint



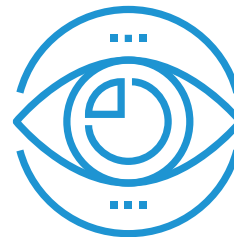
**3200** collaborators



**R&D to industry**



**300 M€** turnover  
**50 M€** of investment



**Progres**

# Our Business Model: Vertically Integrated

## R&D

80 people with various skills

Surface sciences, materials, process, characterizations, machine



## Engineering

From key technologies to machine designing and manufacturing,



**Surface treatments on your components from prototypes to mass production**



## Components

Designing and manufacturing bushings or friction components and optical components



**From R&D To production... worldwide**



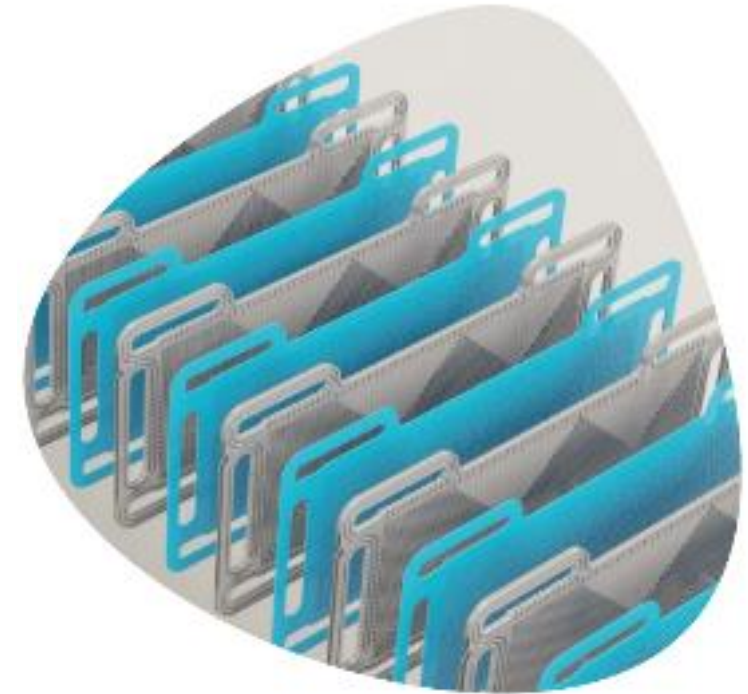




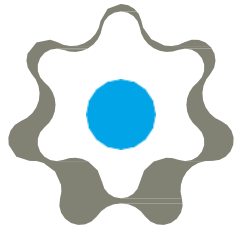
TRIBOLOGY



PHOTONICS



TECHNOLOGIES  
OF THE HYDROGEN



**HEF**<sup>®</sup>  
**PHOTONICS**

## Photonics Business Unit (240 personnes)

**KERDRY**  
Lannion  
Côtes-d'Armor  
(22)  
25 personnes

**NEYCO**  
Vanves  
Hauts de Seine  
(92)  
20 personnes

**FICHOU**  
Fresnes  
Val-de-  
Marne (94)  
37  
personnes

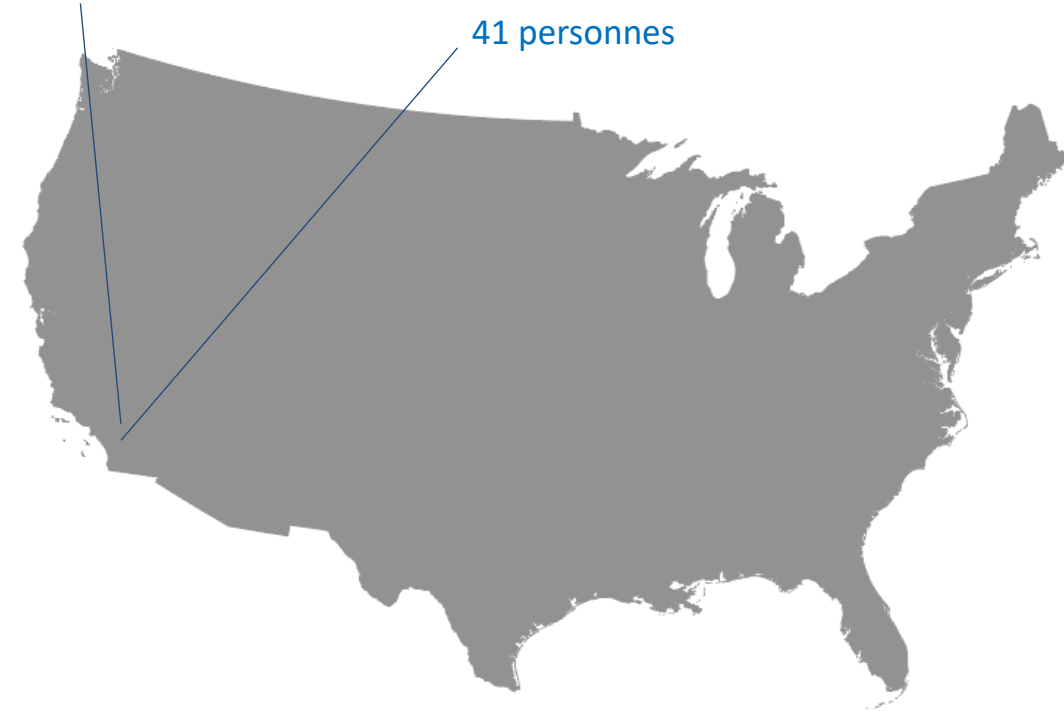
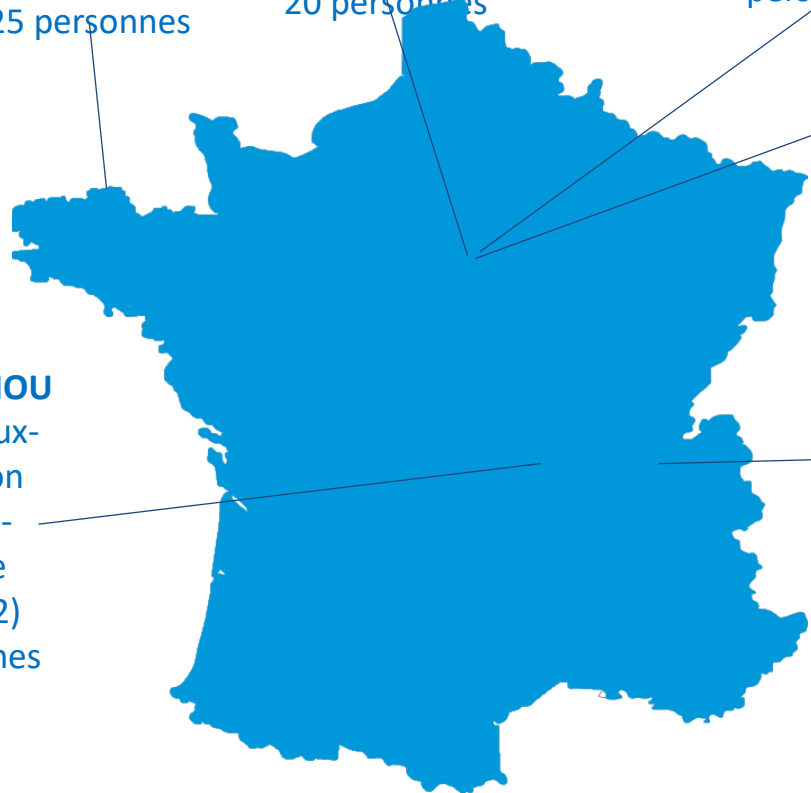
**ABRISA  
TECHNOLOGIES**  
200 S. Hallock Drive  
Santa Paula,  
Californie 93060  
77 personnes

**ABRISA  
TECHNOLOGIES**  
1401 Abalone  
Avenue  
Torrance, Californie  
90501  
41 personnes

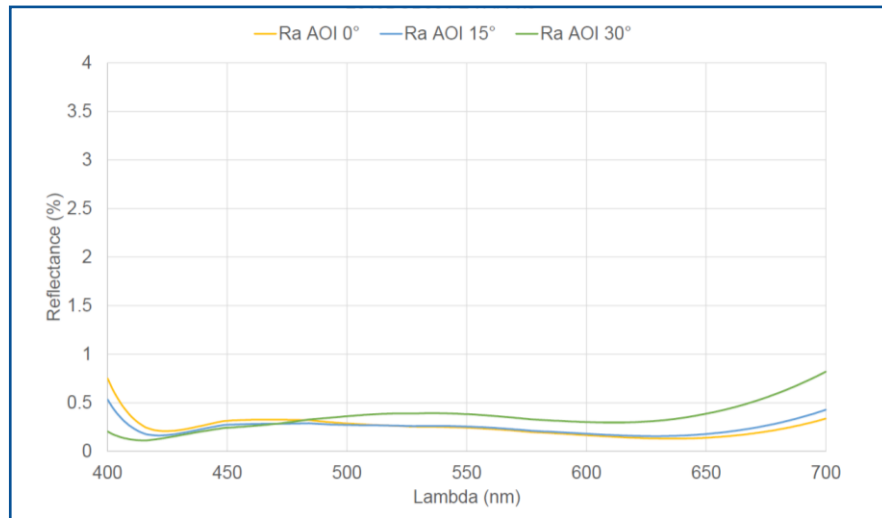
**OPTIMASK**  
Morangis  
Essone (91)  
18 personnes

**HEF - FICHOU**  
Andrézieux-  
Bouthéon  
et Saint-  
Etienne  
Loire (42)  
5 personnes

**ACERDE**  
Sainte Hélène du Lac  
Savoie (73)  
14 Personnes

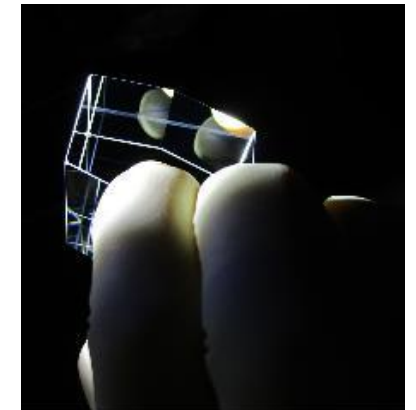
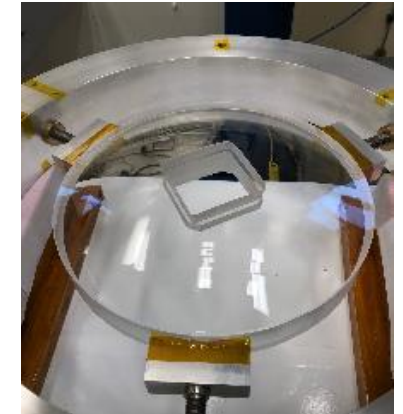
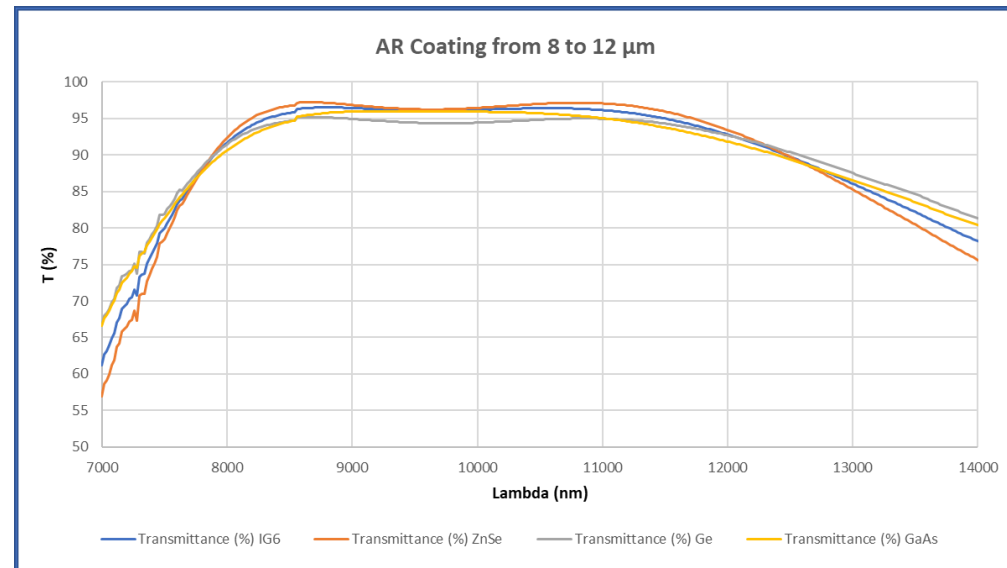


Antireflective coatings (V-coating, W-coating, wide band BBAR...)  
 Materials : TiO<sub>2</sub>, Ta<sub>2</sub>O<sub>5</sub>, HfO<sub>2</sub>, SiO<sub>2</sub>, MgF<sub>2</sub>, ZnS, Ge, hydrophobe



*Typical visible AR Coating (on 1 side)*

*Typical infrared AR Coating (on 2 sides)*



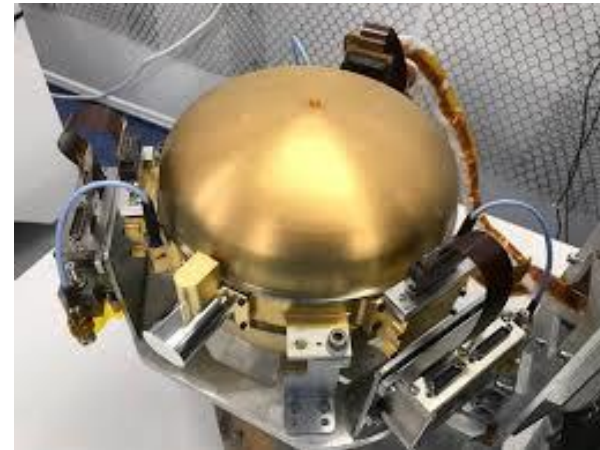




KERDRY  
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## ❖ Metallic & Dielectric Mirrors

- ❖ Silver, Aluminum, Gold Mirror
- ❖ Dielectric Mirror :  $R > 99,5\%$



*SEIS – Mars InSight Program*



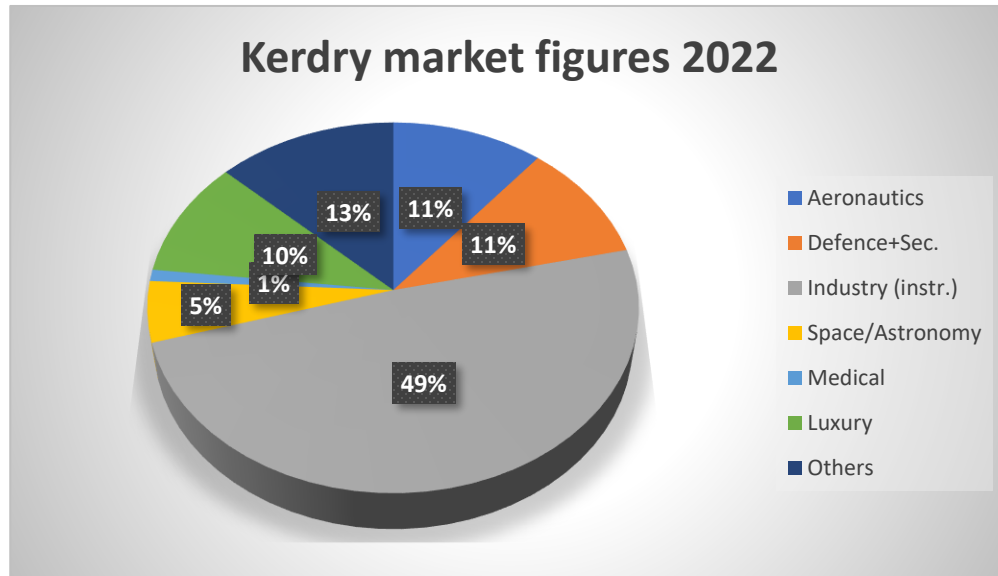
*CTA Project  
(more than 150  
mirrors done)*





**KERDRY**  
HEF<sup>®</sup> PHOTONICS

## Markets:



## Sales Geographical Distribution:

- ❖ North America (5%)
- ❖ European Union (95 %)

**Turnover >2M€ (2022)    2-digit EBITDA**  
**CAGR >100% (2023-2028)**

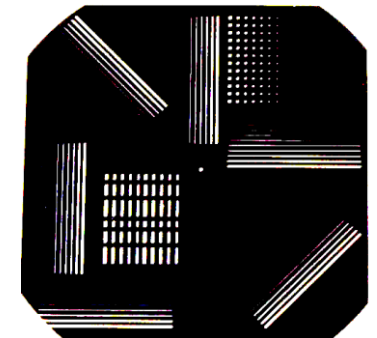
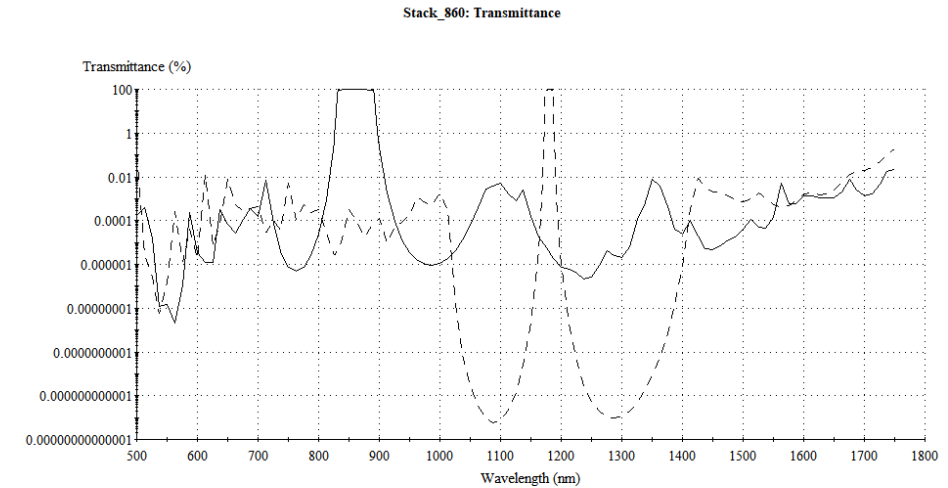


CONFIDENTIAL GREEN  
NO REDISTRIBUTION RESTRICTIONS



# EO Filtering- a typical MultiZoneFilter

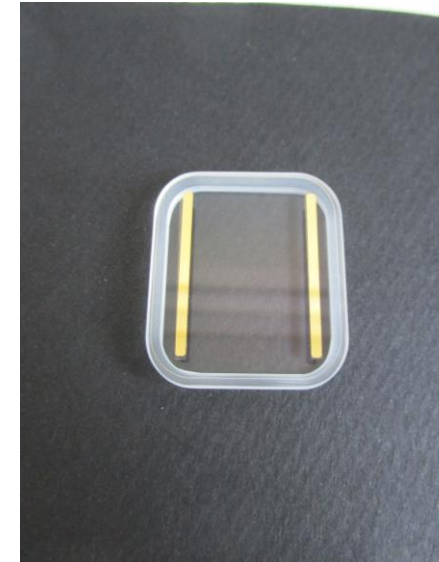
- ❖ Highly selective, 10nm bandwidth with high rejection level, up to C 5: VNIR (400-900nm) & SWIR (1,4-2,4 $\mu$ m)
- ❖ Structured component with accurate positioning of filters by using sequential photolithographic process (mosaïque/butcher block)
  - **photo-lithographically** patterned monolithic multi-zone arrays
  - **hybrid builds** using patterned monolithic elements assembled together as a butcher block
    - Improved bandpass transmittance
    - High attenuation over rejection range
    - Spectral band adapted to customer specifications (0.3 – 3)  $\mu$ m
- ❖ Environmental tests protocols to ensure Space qualifications (related to ECSS, ISO, MIL norms)





# ITO. Concept and applicabilities

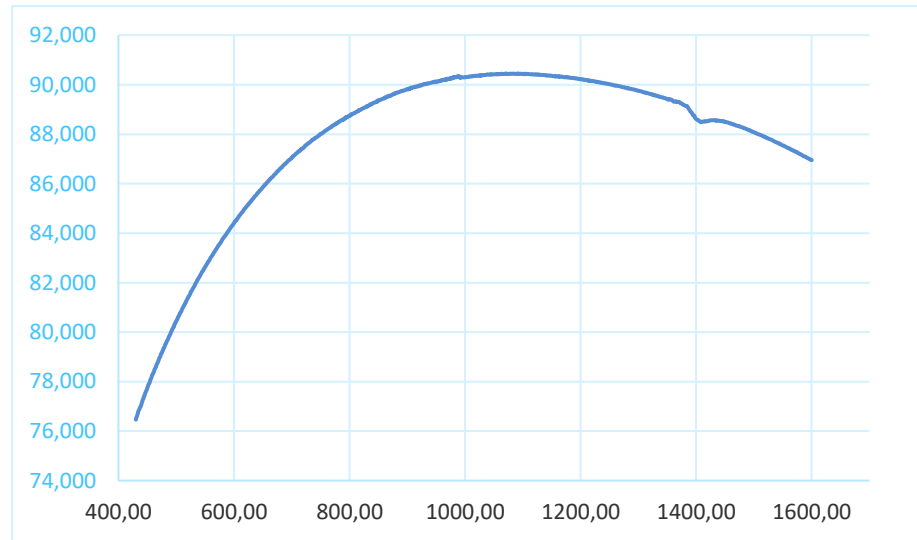
- ❖ **ITO (Indium Tin Oxide) coatings** can be applied on a variety of substrates, including glass (and even plastics)
- ❖ Mainly applications are:
  - EMI/RFI shielding**
  - ESD** (protection against electro static discharge)
  - heated optical filters for displays**
  - Active components for touch-screens
  - High performance electrodes for photovoltaic cells
- ❖ **Light transmission, absorption and reflection** are determined by the properties of the coated layer (PVD-based). Standard coatings are chosen for optimum light transmission (>80%). Generally they lie in VIS up to 1,5 micr. Range.
- ❖ **High conductive busbar** to create a contact area from the coating to the surface of the substrate as an option.



# Kerdry ITO figures of merit

- ❖ Transmission ( $T > 80\%$ ) in VIS/NIR range.
- ❖ Resistivity =  $f(\text{grain density, film thickness})$

Thickness (nm)	Ohm/sq.
221	20
346	14
430	12
518	10
682	9
947	< 7,5



- ❖ Grain density depends not only on PVD technology used, but also in post growths treatments used.
- ❖ Competitive technologies -as “metal grids”- more expensive and undoubtedly not convenient for “small f”





# Kerdry ITO..... coming up soon

- ❖ **ITO/flash metal/ITO** to further optimise shielding beyond 1s of GHz range & high power RF sources (RADAR)
- ❖ **Index-Matched Indium Tin Oxide (IMITO)** (medium long term) for telecom. C & L bands.
- ❖ Integration with other coatings résistant to high energy fluxes and ATOX résistances
- ❖ Markets:

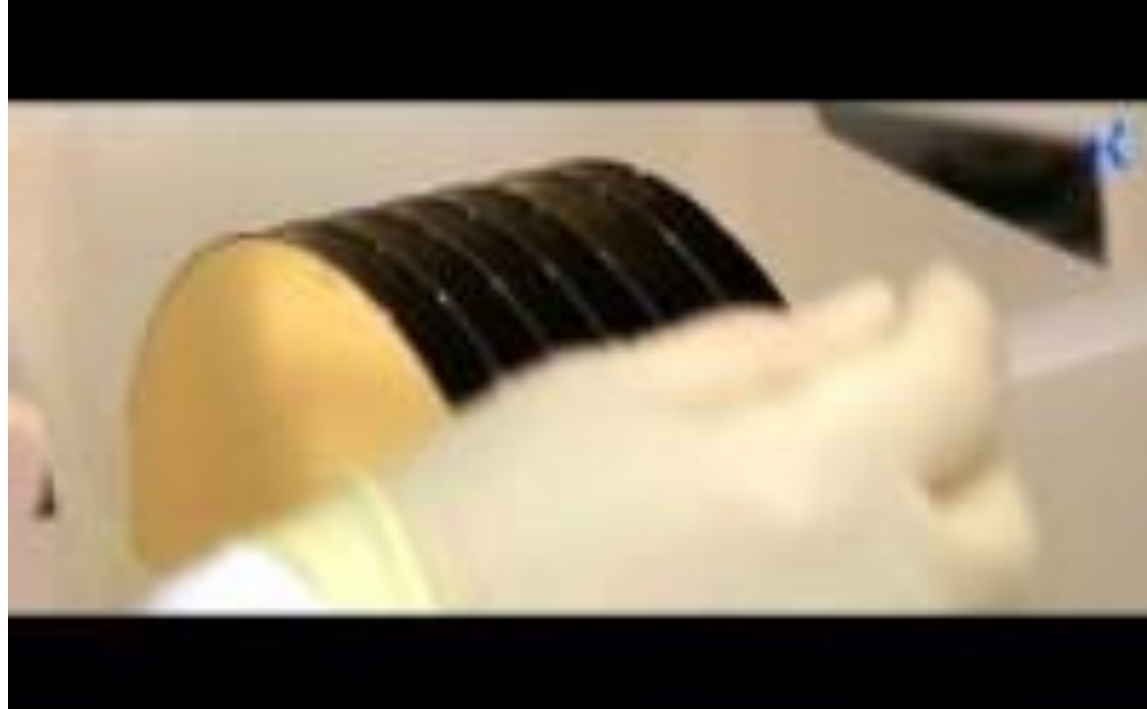
Defence and Sec: C4ISR systems (even for long f)

Space: VLEO satellites and high accurately metrology in general.



*Delighted to listen your requirements and propose the best shielding solution for your optical systems*

## A VISIT TO OUR FACILITY....LETS GO!

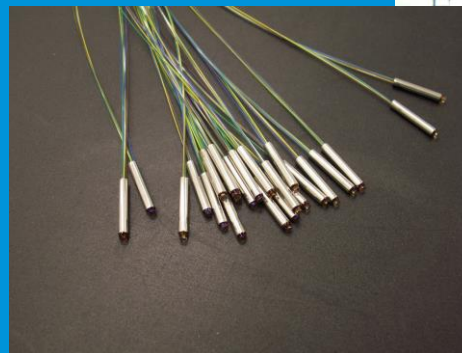


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