

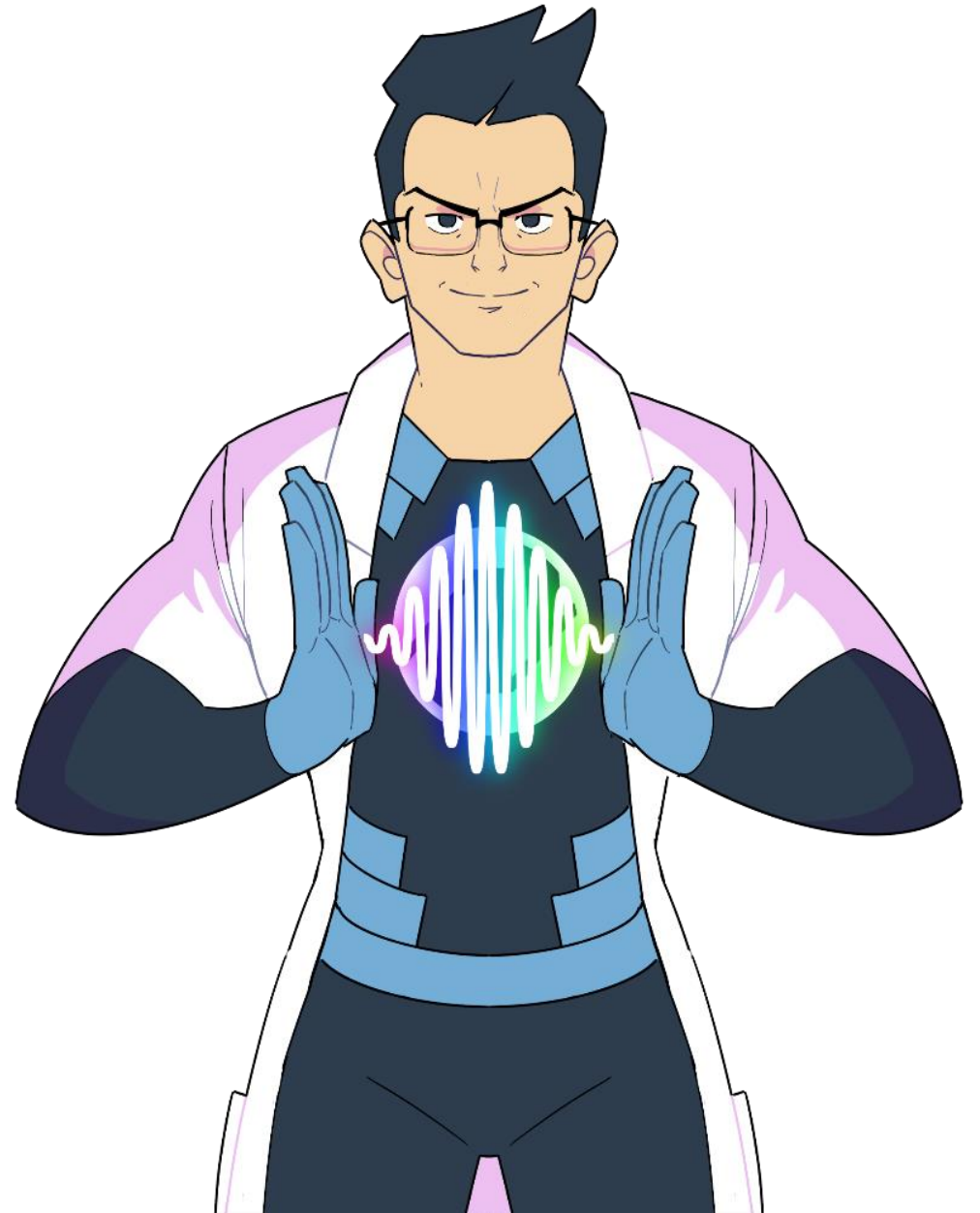
# OPTOMAN

YOUR SIDEKICK FOR  
LASER OPTICS DEVELOPMENT

EPIC AGM 2022 in Vilnius  
[Finally]

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# All optical components look the same...But they are different



Extreme low-loss Mirrors



Mirrors For Big and Scary fs/ps Lasers



Mirrors for Multipass Cells (MPC)



IBS Coated Optics for Ho:YAG, Tm:YAG, Er:YAG Lasers



Gires-Tournois Interferometer (GTI) mirrors



Thin Film Polarizers



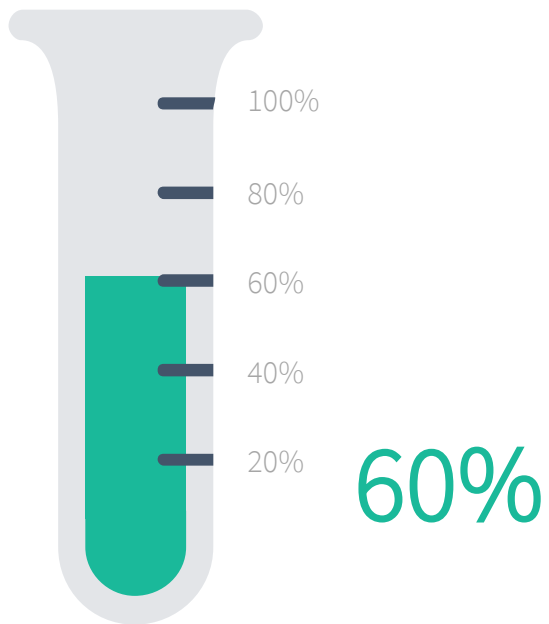
Wavelength Separators



Multi-wavelength Mirrors for Medical Laser Systems

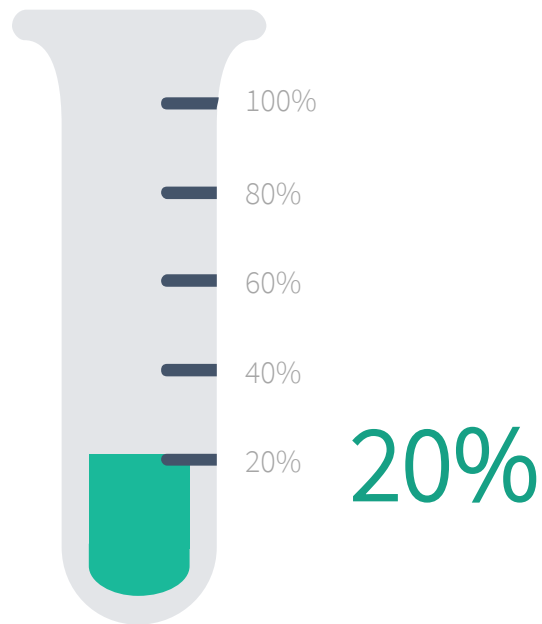


# Performance, reliability, lead time and, eventually, price trade-off



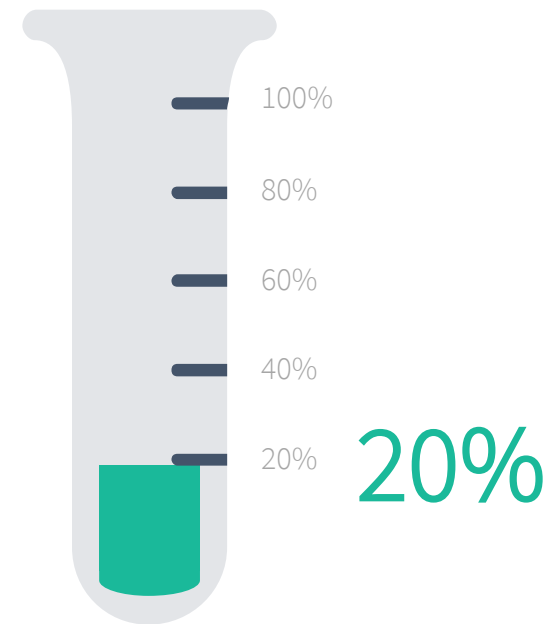
1<sup>st</sup> priority

Laser Induced Damage Threshold



2<sup>nd</sup> priority

Spectral performance



3<sup>rd</sup> priority

Price

· HOW DO WE  
DO THAT?



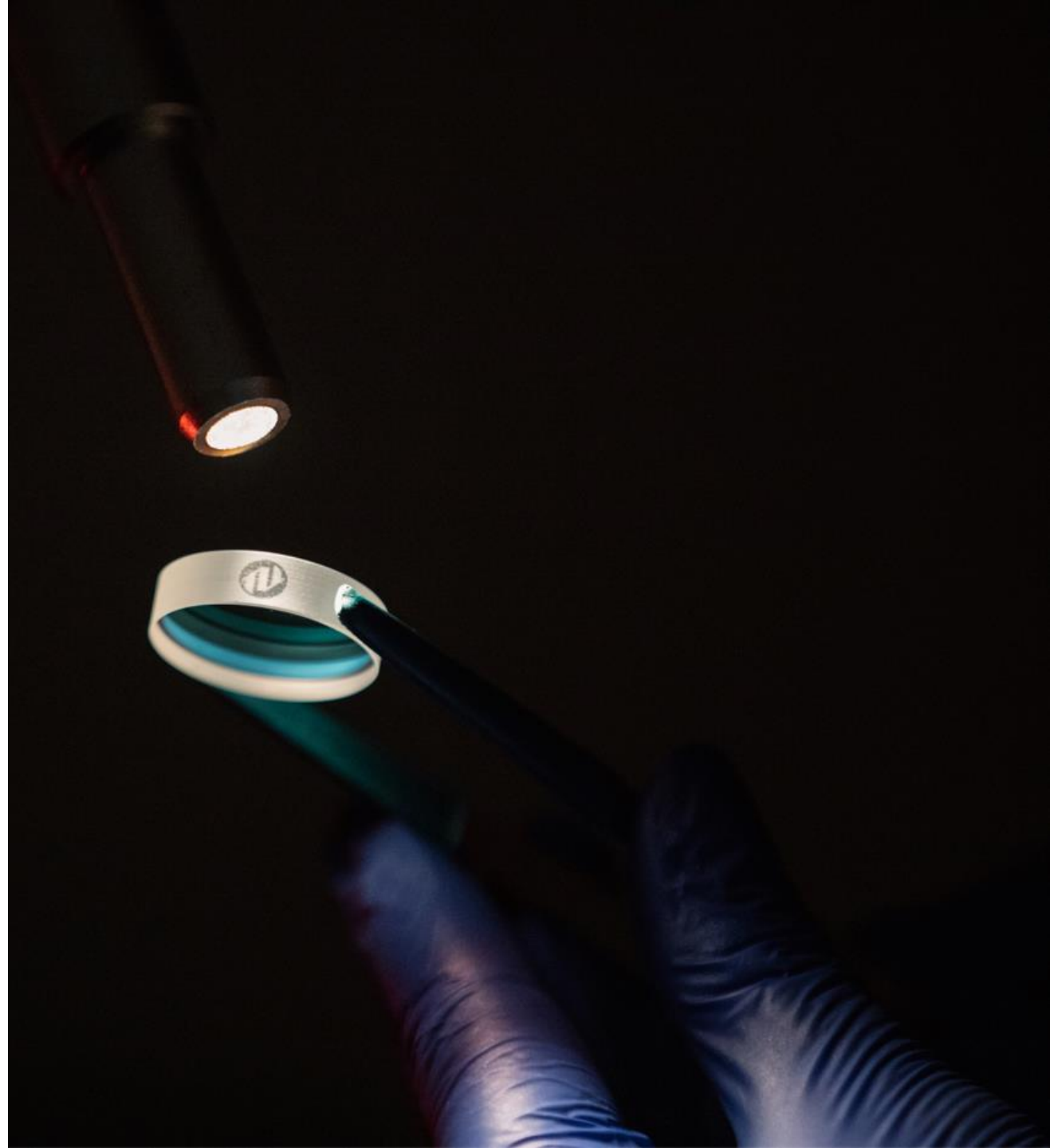
# Concentration

Highly customized and application-optimized laser optics for **high power** and **ultrafast lasers** with **ultrafast turnaround**.

R&D-driven issues solving on the fast-track to serial production.

*„Intelligence is a privilege, and it needs to be used for the greater good of laser people.“*

*Dr. Otto Octavius*



# Concentration

Single manufacturing  
technology

Ion-Beam Sputtering





## PETRA

Effective ( $\pm 0.5\%$  edge-to-edge uniformity) coating area  
 $\varnothing 270$  mm x 2 pallets

## ALBERT – THE ATOM SMASHER

Effective ( $\pm 1\%$  edge-to-edge uniformity) coating area  
 $\varnothing 600$  mm x 2 pallets



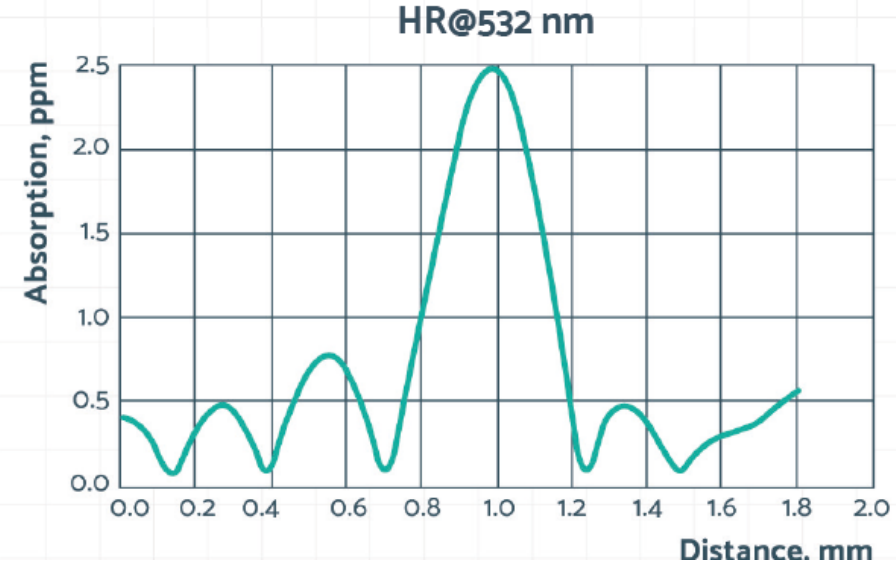
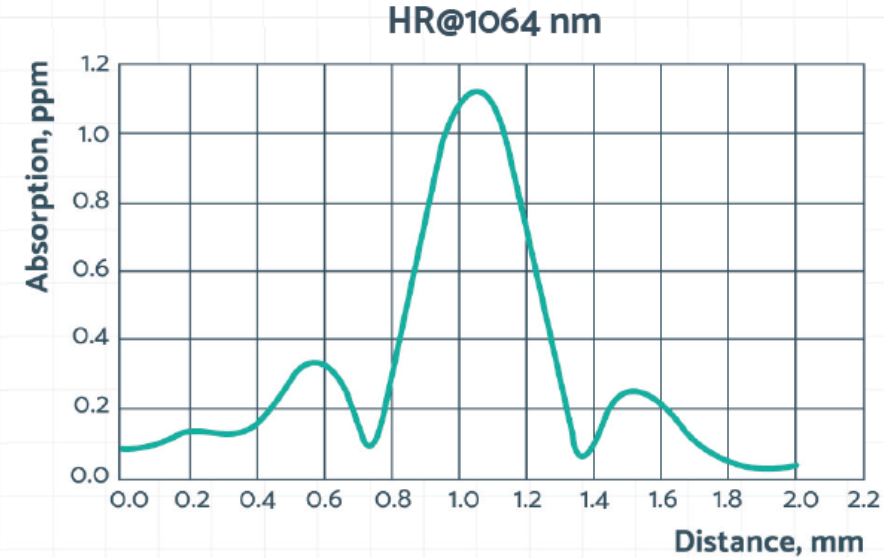
# Ion-beam Sputtering advantages and disadvantages over Alternative technologies

	Ion Beam Sputtering	Magnetron Sputtering	Electron Beam Evaporation	Ion Assisted Deposition
Absorption	<2 ppm	<10 ppm	<100 ppm	<50 ppm
Roughness	< 1.5 Å RMS	<5 Å RMS	≥10 Å RMS	≥8 Å RMS
Laser Damage Threshold (1064 HR)	>70 J/cm <sup>2</sup> , 20 ns	>10 J/cm <sup>2</sup> , 20 ns	5-30 J/cm <sup>2</sup> , 20 ns	5-30 J/cm <sup>2</sup> , 20 ns
Thermal Conductivity	High	High	Low	Medium
Density	Near Bulk	Near Bulk	Porous	Dense
Adhesion and Durability	Excellent	Very Good	Low	Good
Humidity Sensitivity	No	No	Yes	Yes, small
Aging Effects	No	No	Yes	Yes, small
Stress	800 MPa	400 MPa	<100 MPa	100 MPa

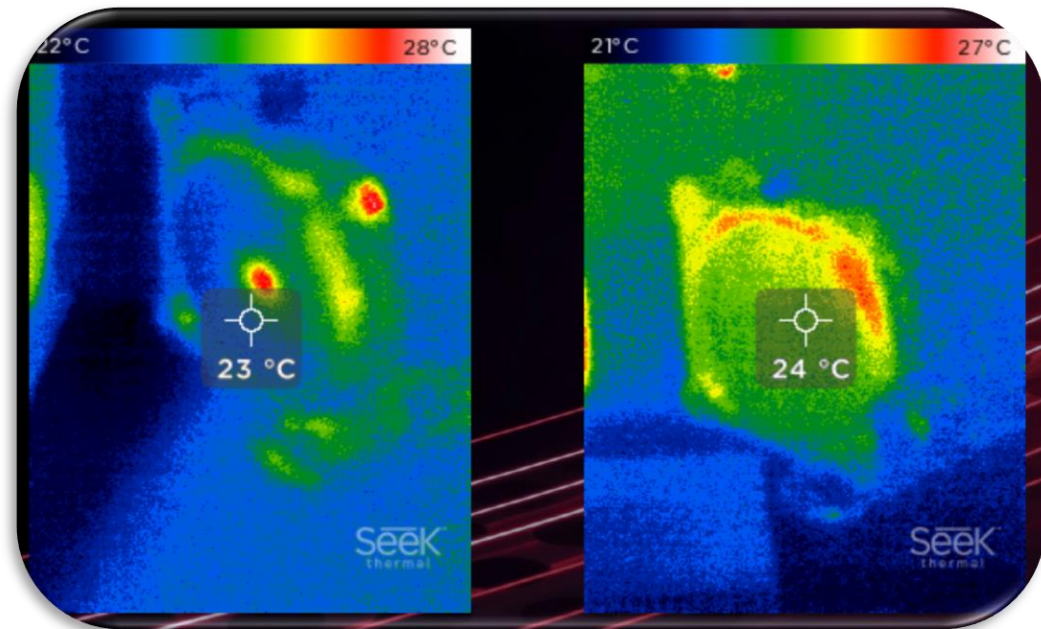
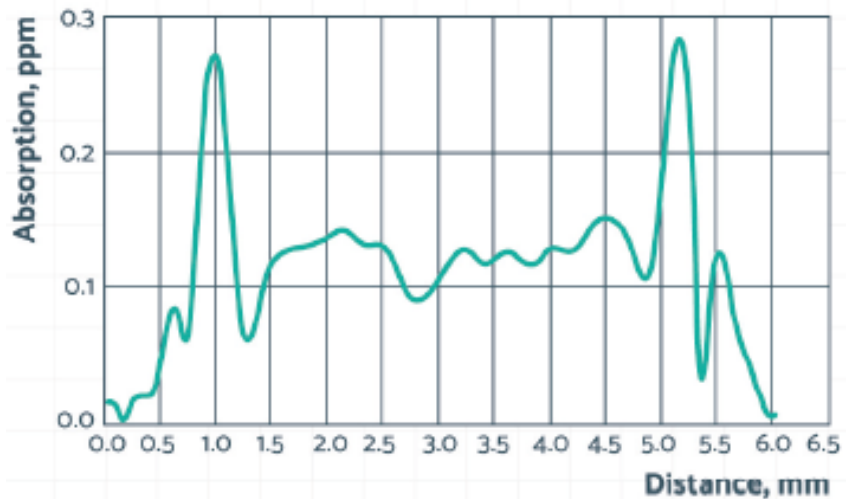
# LOW ABSORPTION COATINGS



# LOW ABSORPTION COATINGS



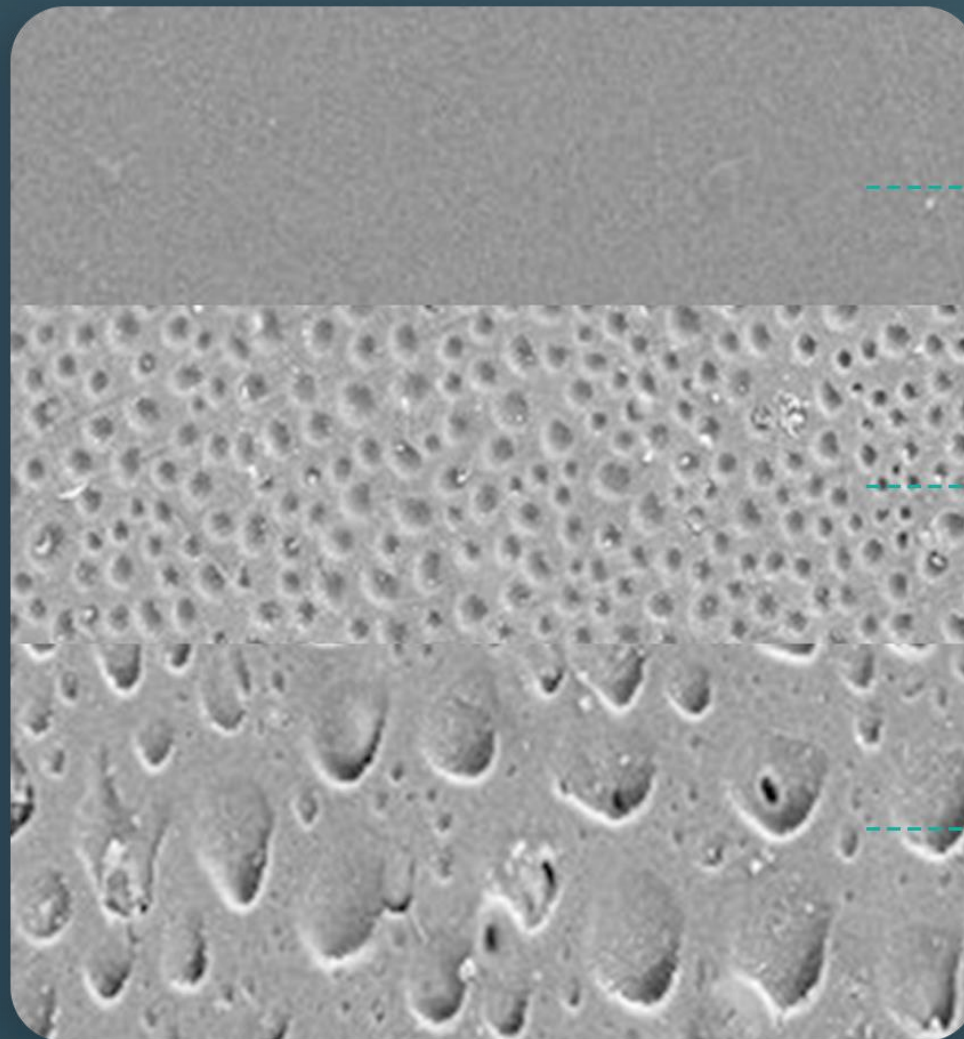
AR/AR @ 1064 nm coating tested @ 1064 nm, AOI=0°



Coating defects

- ◆ Porosity and environmental stability.

- Water absorption.



ION-BEAM  
SPUTTERING

ION-ASSISTED  
DEPOSITION

ELECTRON  
BEAM  
EVAPORATION

# STABILITY OF IBS COATINGS

Temperature cycle tests at per MIL-F-48616

IBS AR coatings are extremely durable and environmentally stable due to the density of layers. Incredible resistance makes them perfect for on-field applications.

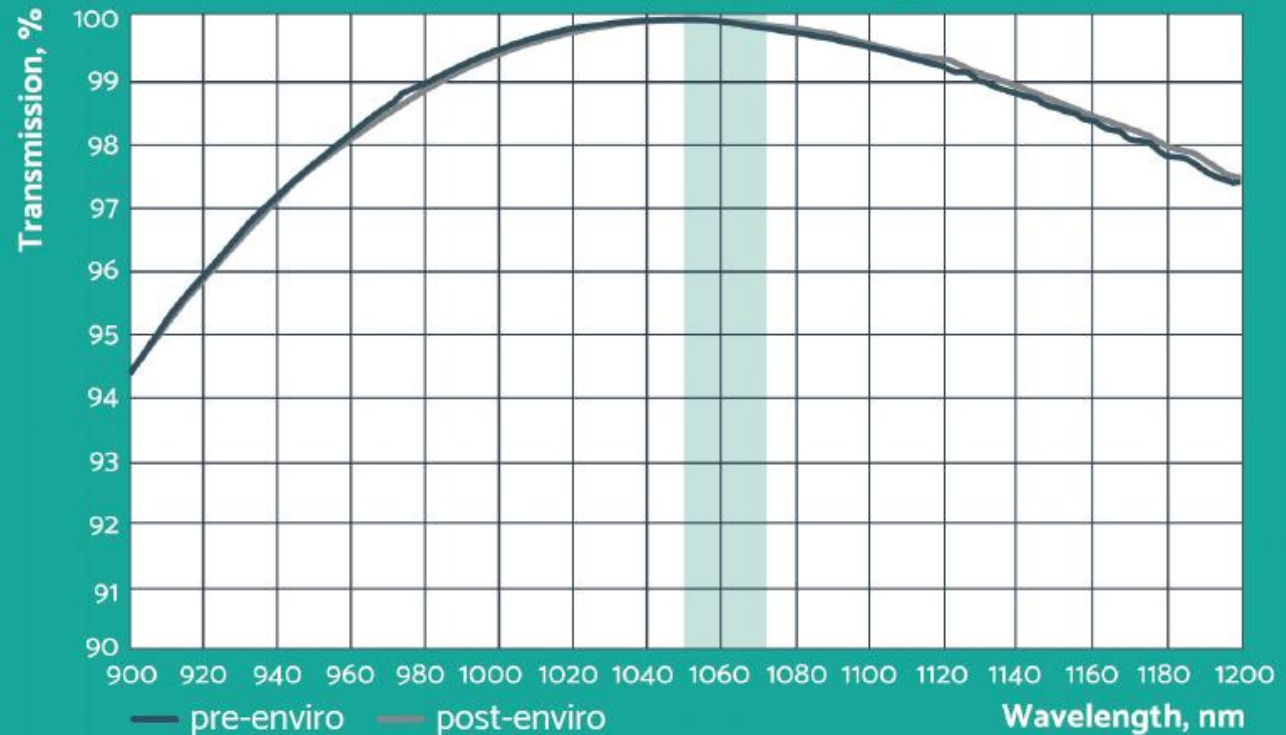


**IBS**  
Near Bulk  
Density



**E-beam**  
Porous  
Structure

AR@1064 nm coated sample performance before and after environment treatment cycles.





# Elimination of “Oh but IBS is expensive” disadvantage

## BEFORE UPGRADE:

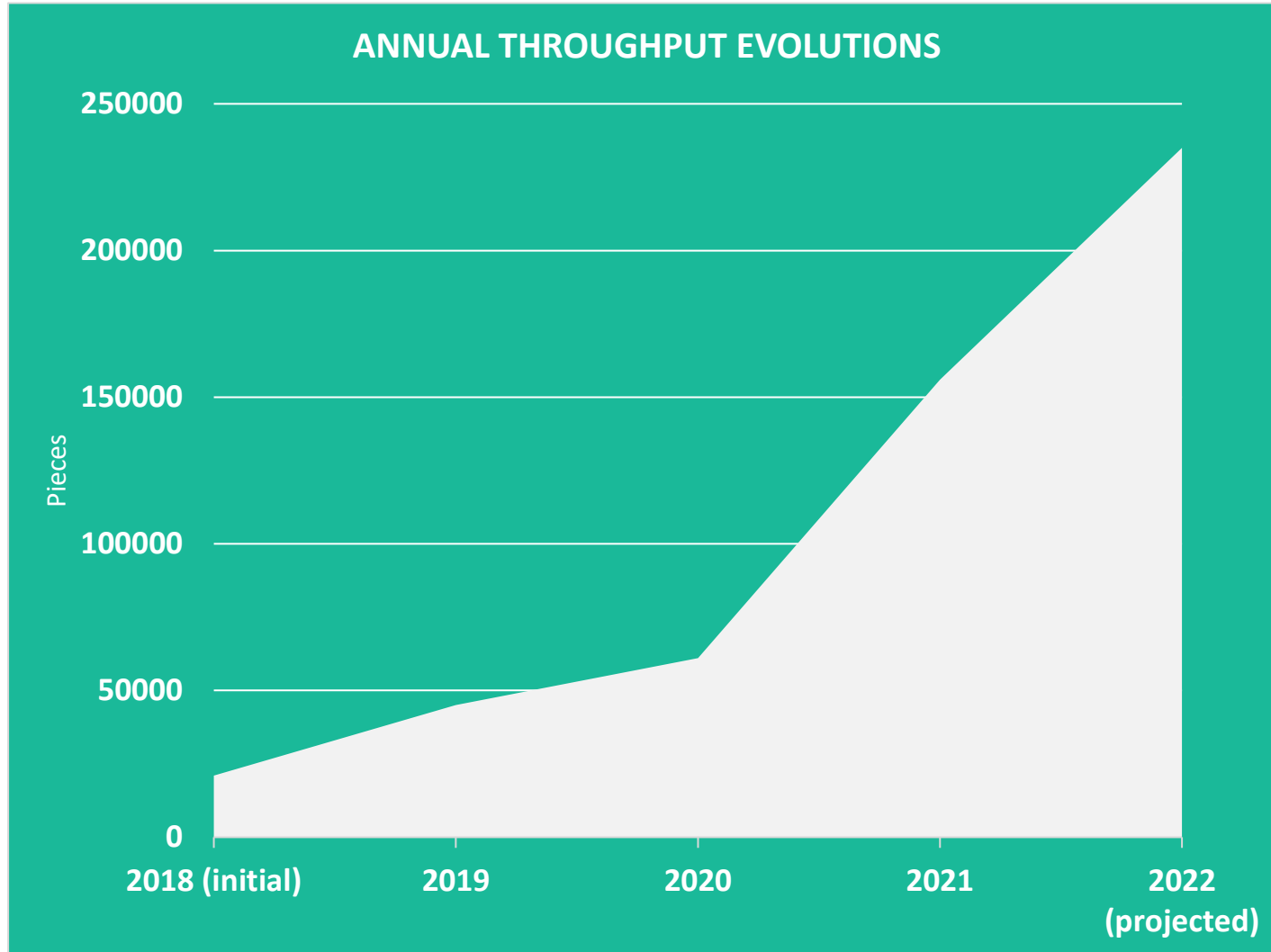
- Max load of Dia120 mm x 1 pc.
- Max load of Dia50.8 mm x 11 pcs.
- Max load of Dia25.4 mm x 50 pcs.
- Max load of Dia12.7 mm x 100 pcs.

## AFTER UPGRADE:

- Max load of Dia120 mm x 2 pc.
- Max load of Dia50.8 mm x 25 pcs.
- Max load of Dia25.4 mm x 120 pcs.
- Max load of Dia12.7 mm x 200 – 250 pcs.







Measurement unit:  
ø25.4 mm, HR@1030 nm,  
AOI=45°

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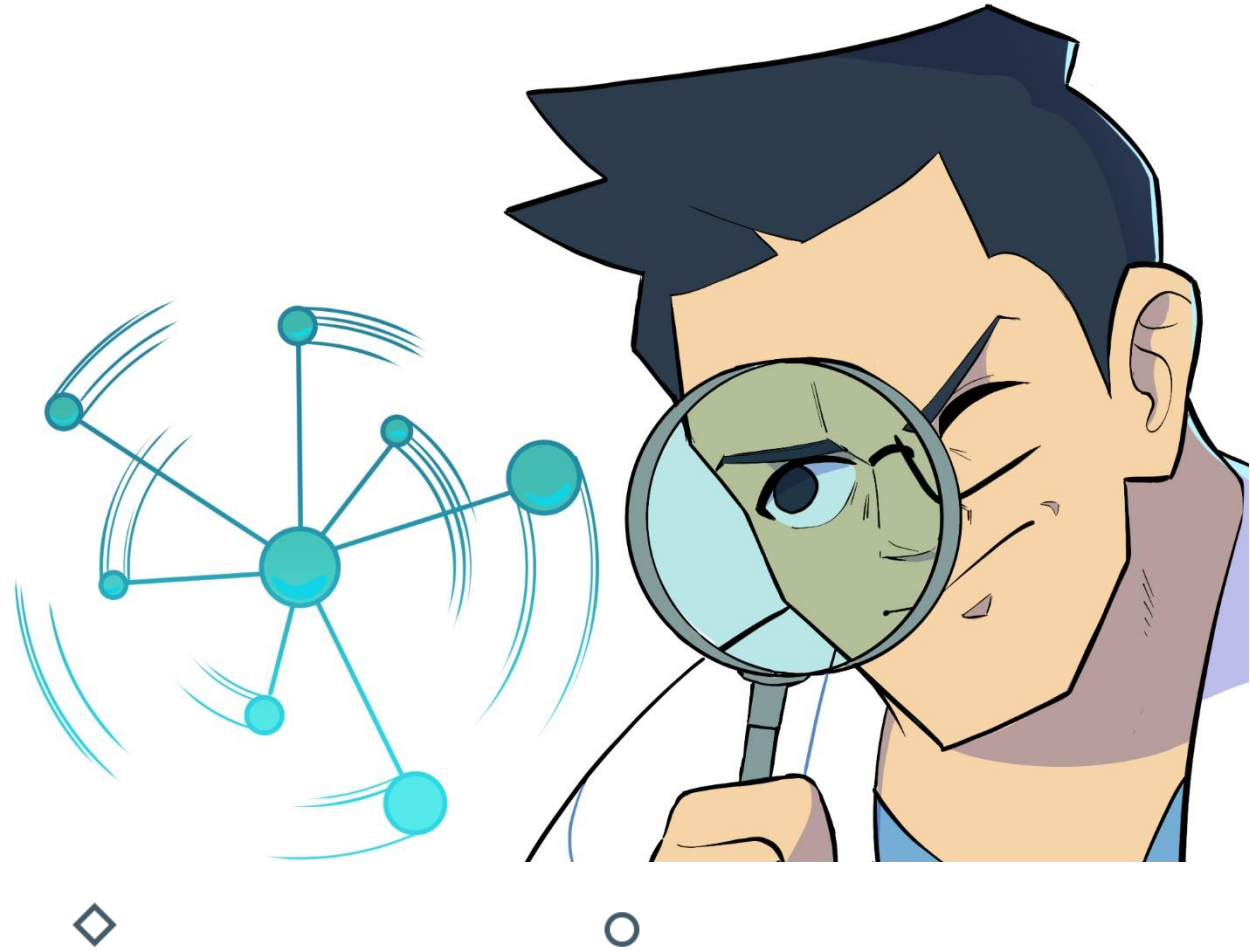
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# · Research & Development

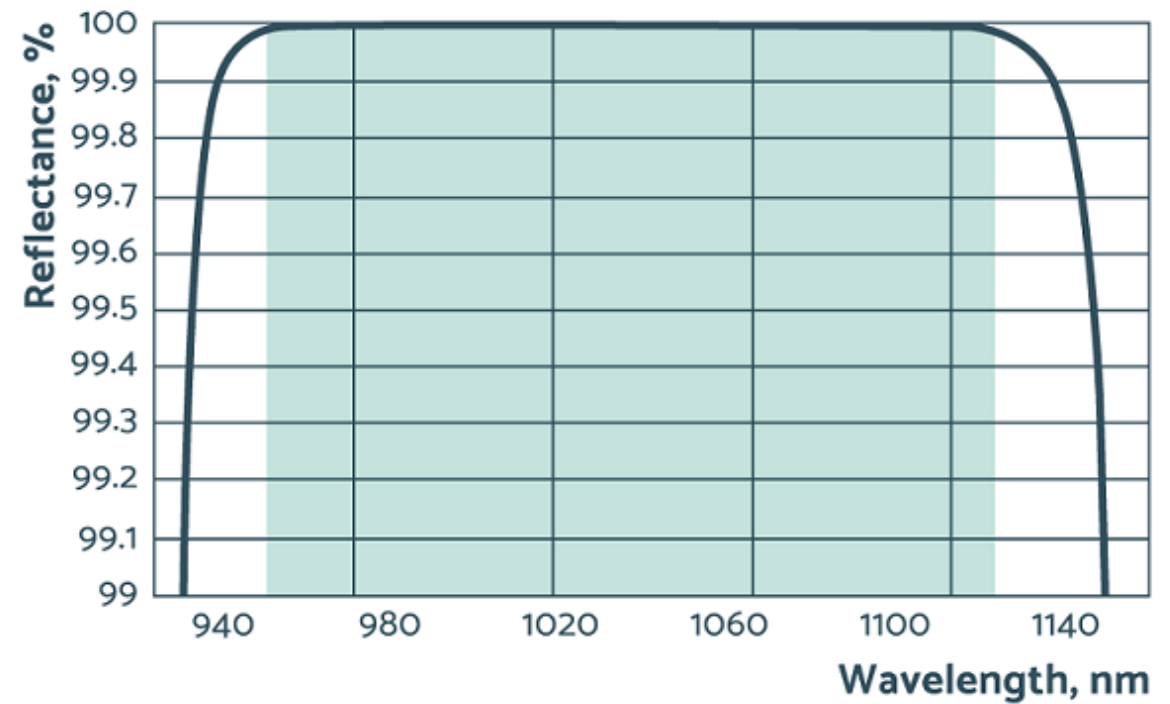
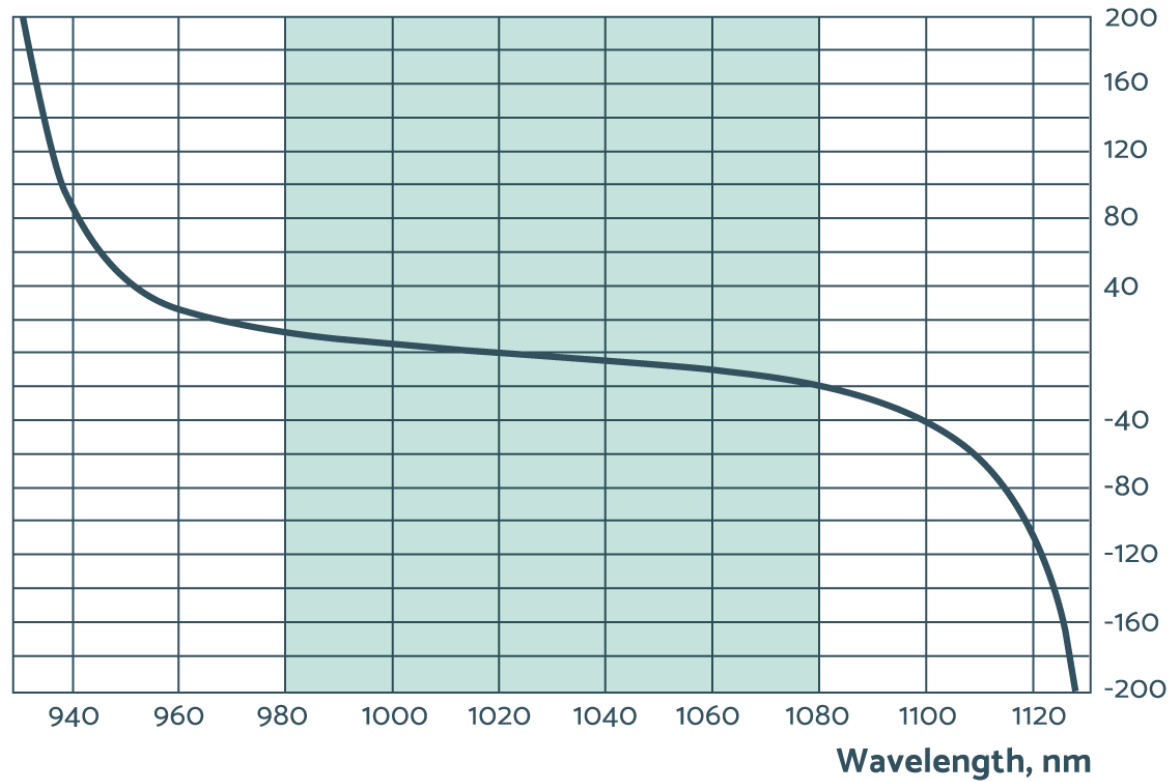
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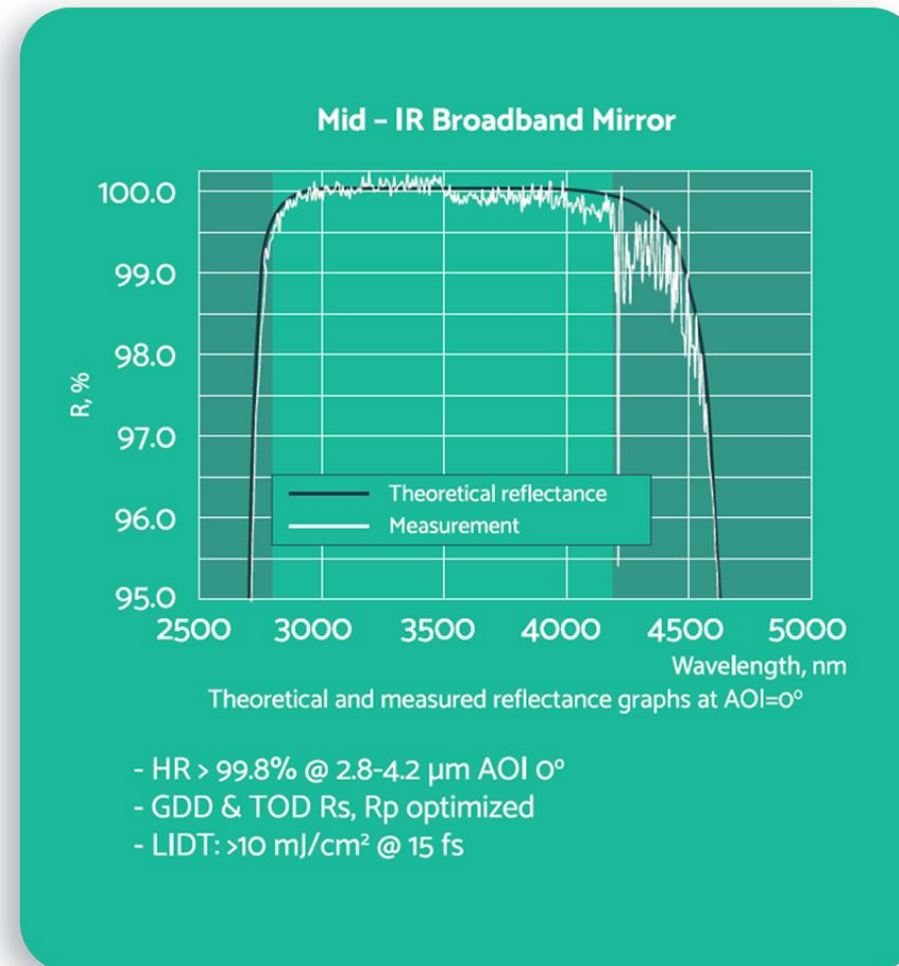
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Target: 300 nm bandwidth



Dielectric and semiconductor coating for 2-5  $\mu\text{m}$  range





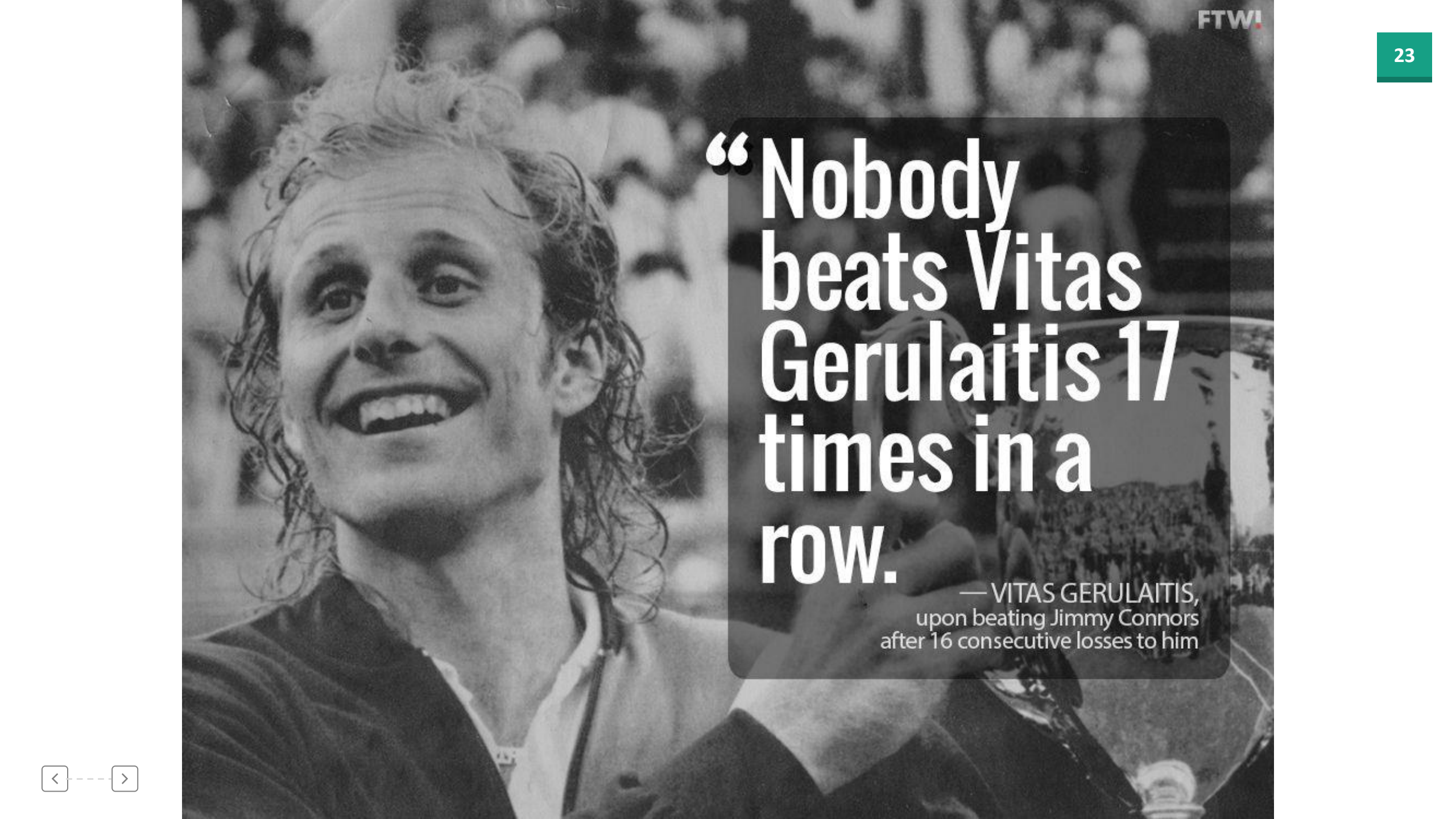
Nonlinear: LBO, BBO, LiNbO<sub>3</sub>...

Laser crystals: Yb:KGW/KYW, Yb:CALGO, Pr:YLF, Ti:Sa, Co:Spinel...

Other fancy materials: SiC for example..



*Absolutely random picture to fill up space 😊*



“Nobody  
beats Vitas  
Gerulaitis 17  
times in a  
row.

— VITAS GERULAITIS,  
upon beating Jimmy Connors  
after 16 consecutive losses to him

