

PRIMOCELER

primoceler.com

**Breakthrough welding solutions
for safer encapsulation**



Primoceler – Your partner for glass encapsulation

GLASS ENCAPSULATION UNIT

Laser based welding tool and software for 2" – 8" wafers
Patented encapsulation method



ENGINEERING KNOW-HOW

Solution specification
Installation and training
Technical support and maintenance



WELDING SERVICES

Laboratory & clean room facilities for testing
Production services

Example applications



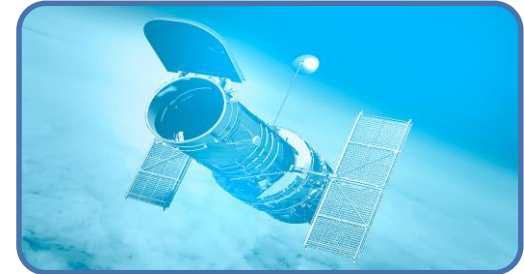
Optical components

- Low HAZ
- Sensitive thin films



Active Implants

- No immunological rejection
- Data transfer possible



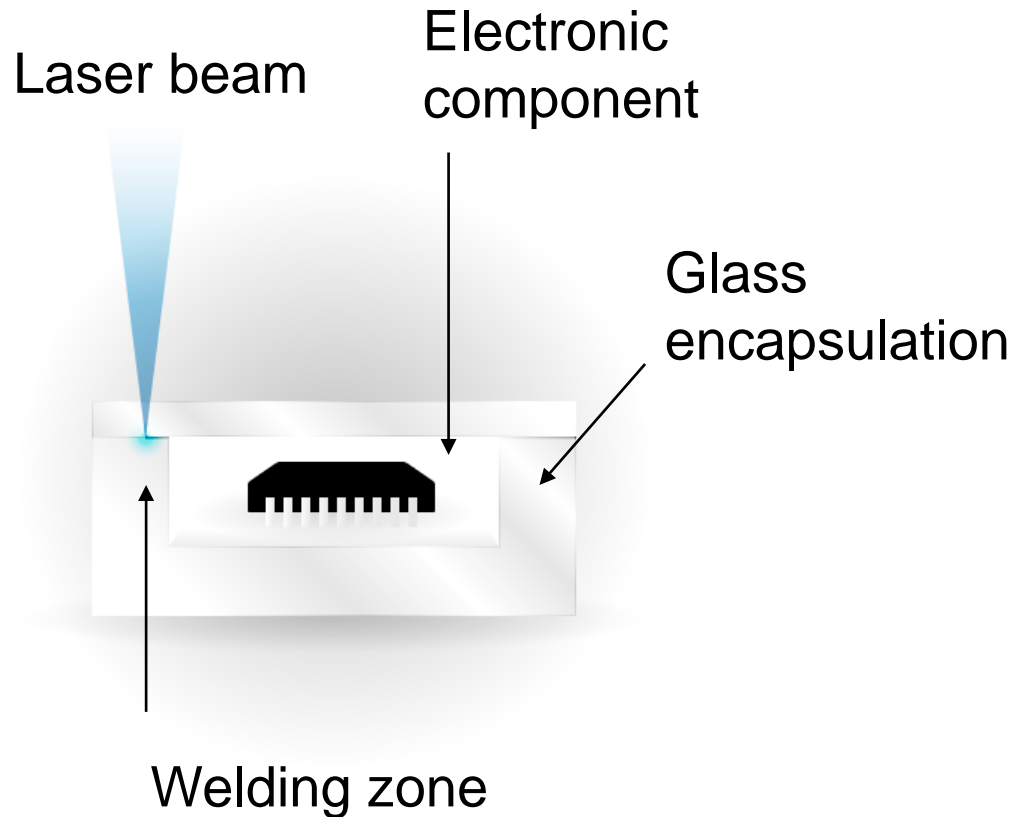
Space

- High reliability and hermeticity needed
- CMOS and other optical sensors

Bonding technologies

	Anodic bonding	Direct / fusion bonding	Glass Frit	Epoxy (UV)	Epoxy (thermal)	Primoceler Laser
Process temperature	440C	Without plasma activation 1000C With activation 440C, some new low-temp –technologies 200C	440C	Room temperature	200C	Room temperature
Surface quality need (Ra)	<2nm	<0.5nm (no plasma) <2nm (with plasma)	<1um	<1um	<1um	< 5nm
Effect of particles	Medium	High (plasma) High (no plasma)	Low	Low	Low	High
Production capability	High +Low volume	High+Low volume (no plasma) Low volume / only R&D (with plasma)	High + low volume	Low volume	High + low volume	High + Low volume
Clean room class requirement	100	10	1000	1000	1000	1000
Other	Silicon or metal needed on the other wafer. Glass-glass not possible	No additives	Additives needed	Additives needed	Additives needed	No additives

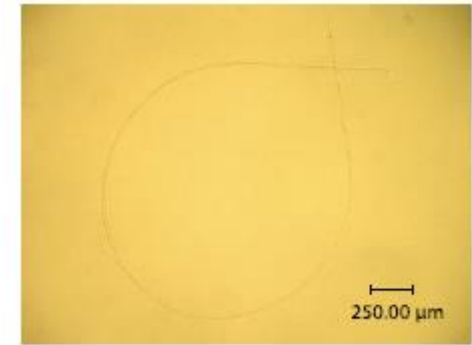
Primoceler Technology



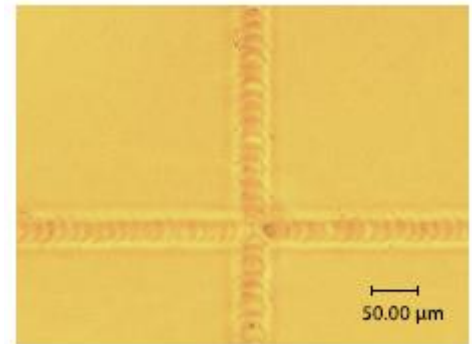
- Based on ultra fast lasers
- Technology leaves material surfaces untouched
- Components inside encapsulation stay under room temperature
- Patented welding technology with several new patents pending

Primoceler Technology benefits

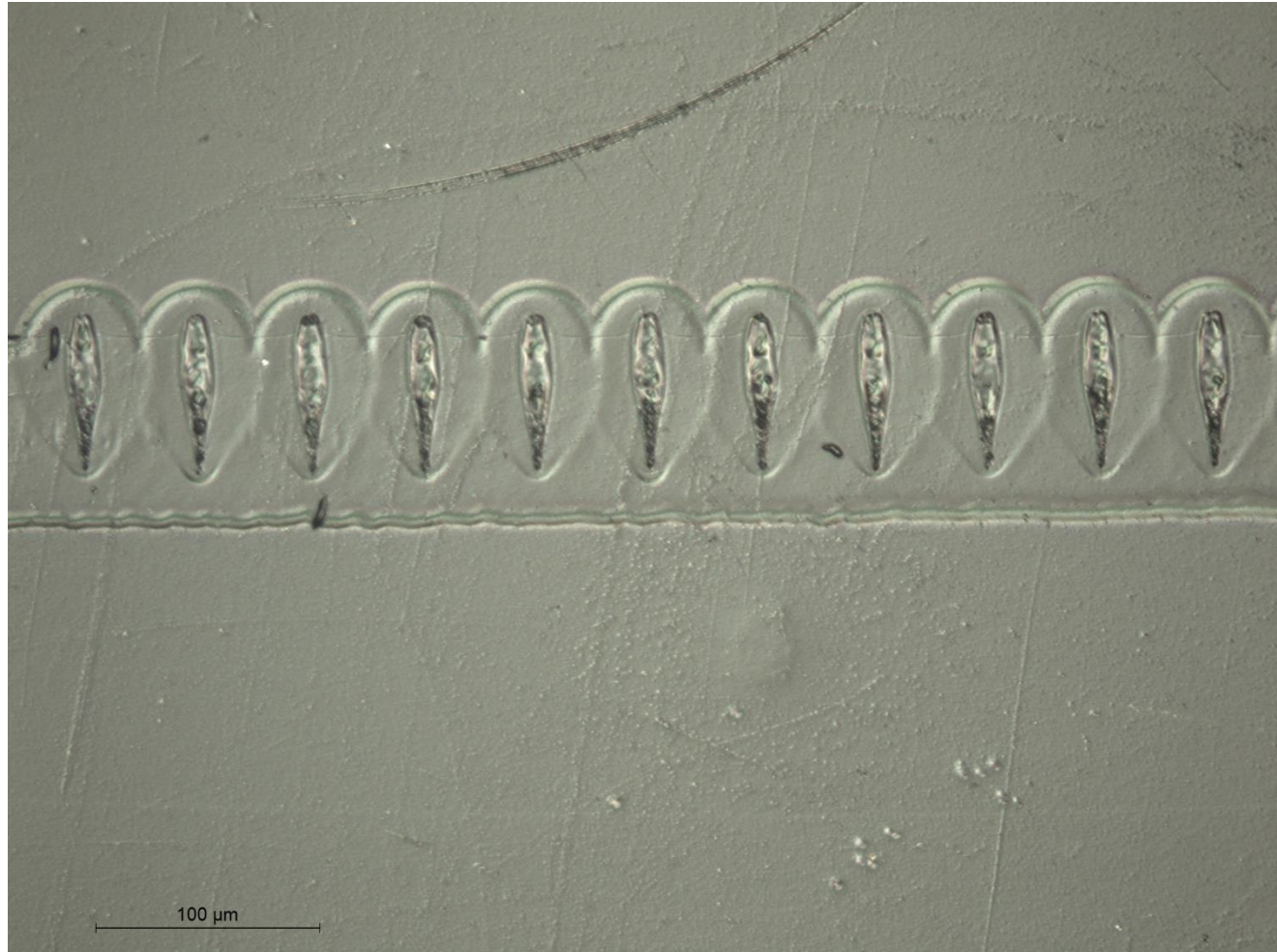
- Miniaturization of end product
 - High precision without heat
 - No post processing needed
 - Neutral – biocompatible
- Superior hermeticity
 - All glass encapsulation and hermetic sealing
- High quality
 - Extremely good mechanical properties
 - Resistant to temperature cycling
 - Longer lifespan
- High frequency applications



Welding of glass on glass



Picture of the seam – Side view



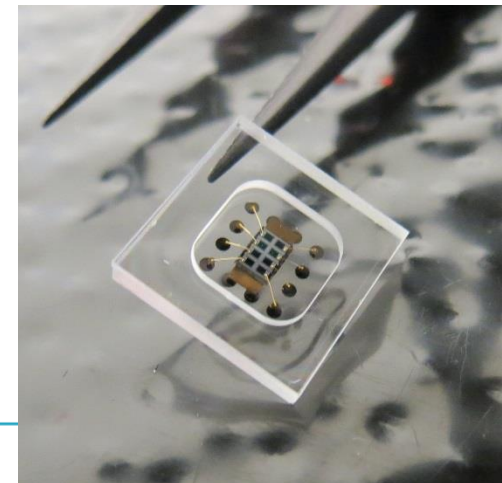
Primoceler bonding technology properties

- **Suitable materials**
 - Most glass types (Borofloat 33, D263, ENA1, fused silica etc.) and silicon
 - Also sapphire and ceramics are possible in some applications
- **Lid / top wafer material thickness 50µm – 2mm**
- **Bottom material thickness: Up to 30 mm**

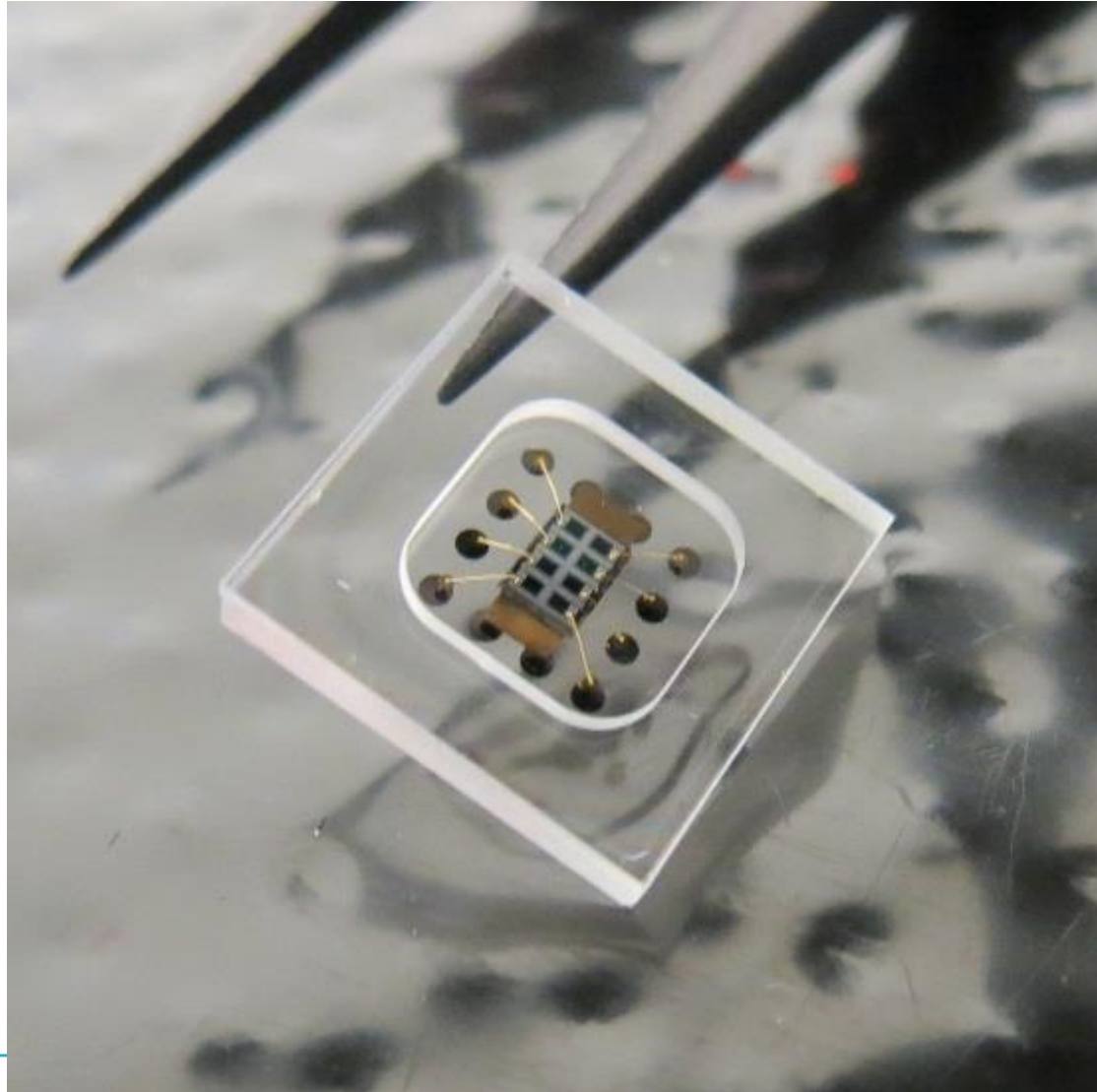
Primoceler bonding technology properties

- Hermeticity - All the devices passed gross and fine leak testing with leak rates **$<6,0 \times 10^{-12}$ atmcm³/s Kr-85**
- Good mechanical strength
Shear force **$> 2\text{kg} / \text{mm}^2$**
- Temperature cycling
 $-55^\circ\text{C} \dots +175^\circ\text{C}$
 - No changes in the seam noticed

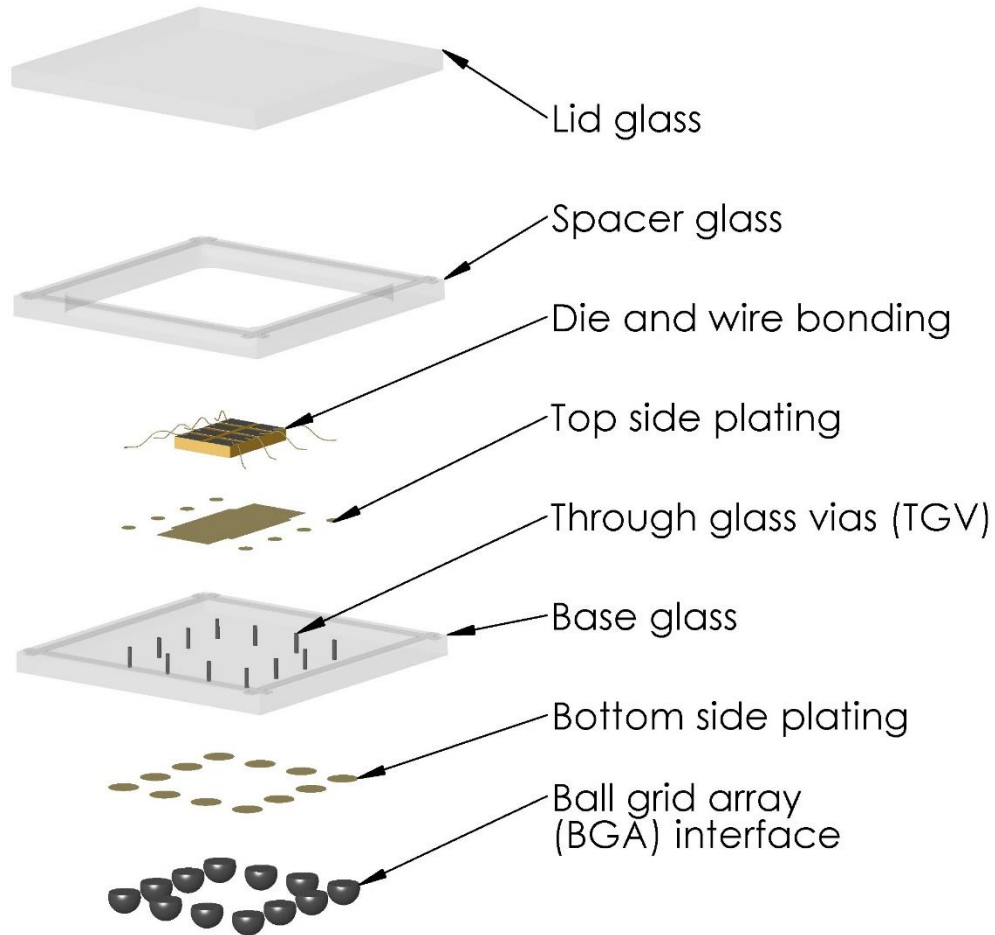
- Packaging an optical sensor in a project with the European Space Agency
- Borosilicate lid, spacer and base plate, thickness of 500 μm each
- Package was encapsulated with Primoceler welding technique
- No adhesives or additives were used



Example device



Example product

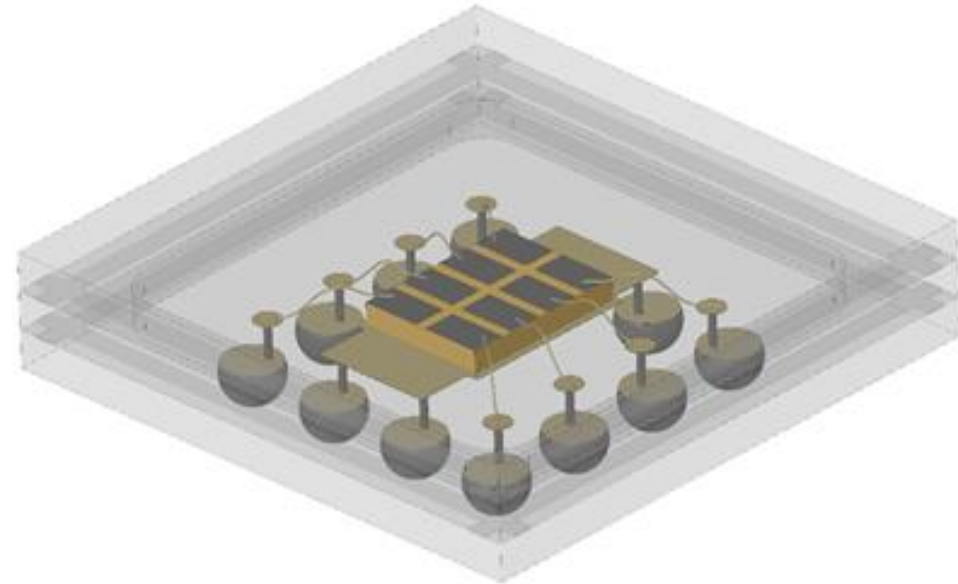


Optical sensor sealed hermetically.
Project with the European Space Agency

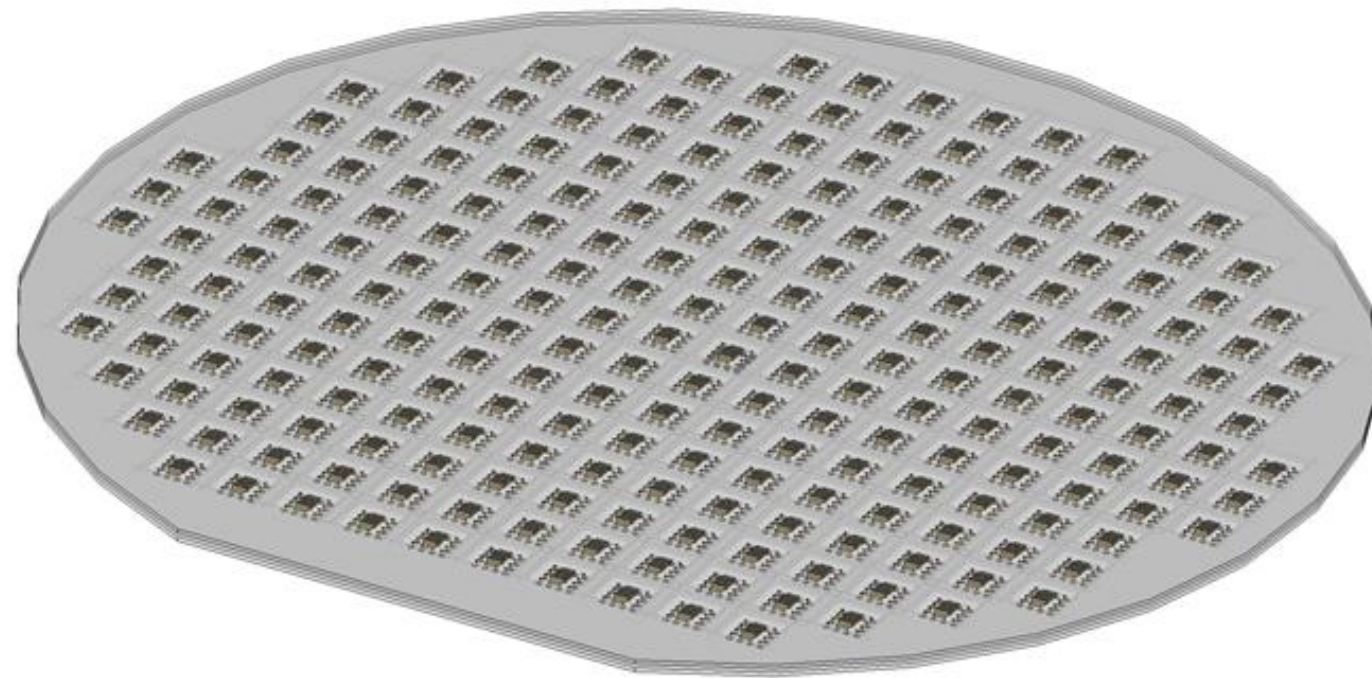
Tested leak rate $< 6.0 \times 10^{-12}$ atmcm³/s Kr-85
Shear strength > 2 kg / mm²

Throughput around 5-30 8" wafer pairs per hour
Throughput is depending on the product

Example product



Diced product



Production on wafer level

Quality assurance

- **High end products**
 - High yield a must



- **Need to define the failed ones**
 - Optical on-line monitoring system developed (sorry for the teaser...)

Primoceler, Inc



- Breakthrough welding technology
- Patented IP
- Industrial process which is used in daily production
- Founded in 2010
- Based in Tampere, Finland
- Co-operation with strong research and laser facilities like Technical Universities, VTT and ESA