



**umicore**  
*materials for a better life*

# 热成像解决方案的低成本光学进展

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Sep. 11th 2024

# Agenda

1. Umicore Introduction
2. Development Drivers and Trends
3. Umicore Solution



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# 优美科集团介绍 Introducing Umicore

2024

# 关于我们

## Who We Are

我们相信，材料科技将为人与地球创造可持续的价值。

我们加速全球移动出行零碳转型，提供下一代先进材料，推动全球实现循环经济。

我们是一家 **循环材料科技企业**，“**材料创造更美好的生活**”是我们的使命。

We believe in the power of materials technology to create positive impact on people, planet and industry.

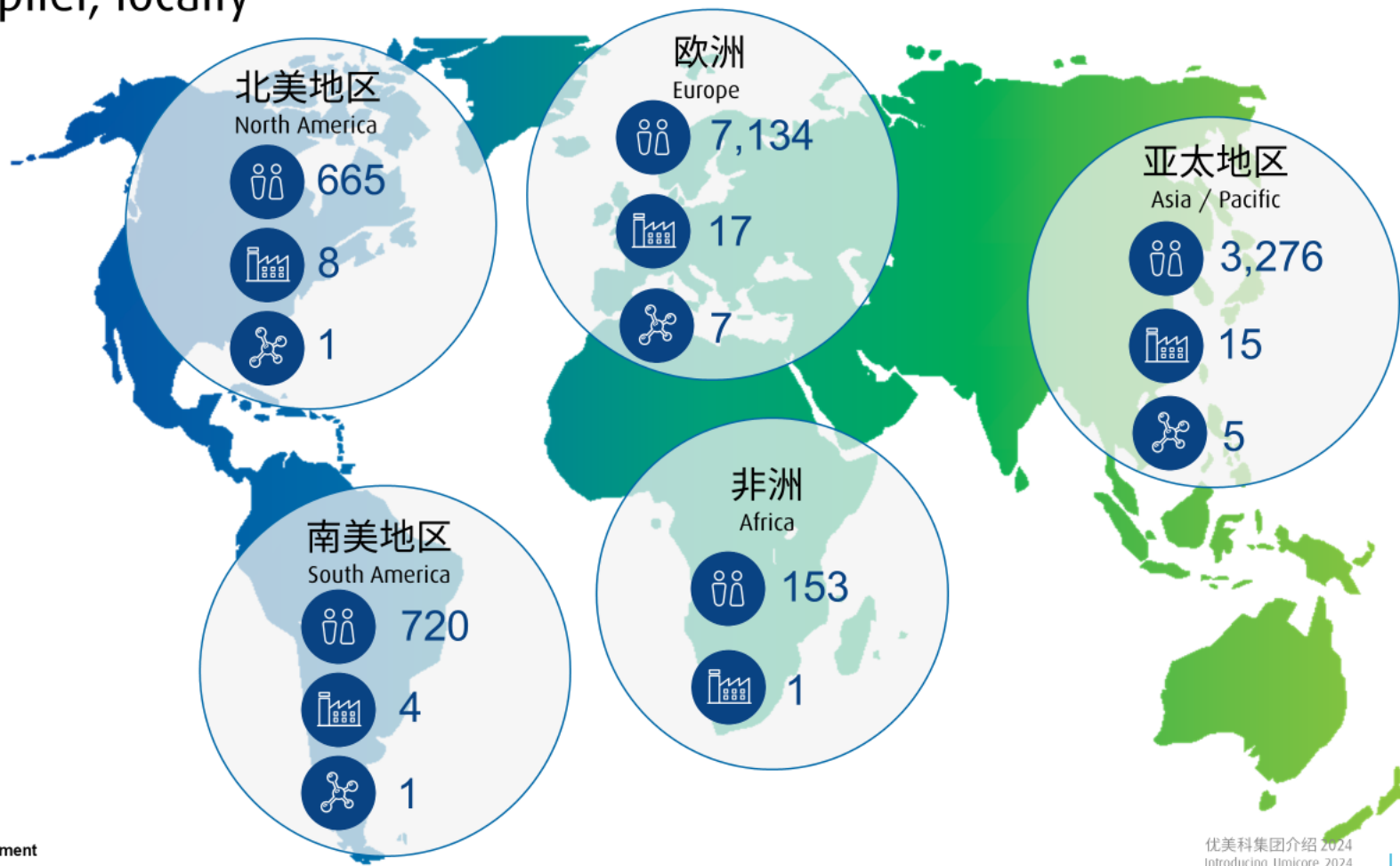
We accelerate the transformation to carbon free mobility, deliver the next-generation of advanced materials and drive the world towards a circular economy.

We are the **circular materials technology** company fulfilling our mission to create **materials for a better life.**

# 全球业务，满足各地需求

## Your global supplier, locally

-  员工  
COLLEAGUES  
**11,948**
-  工厂  
PRODUCTION SITES  
**45**
-  研发技术中心  
R&D | TECHNICAL CENTERS  
**14**



# Infrared Solutions



**Infrared  
Optical  
Assemblies**



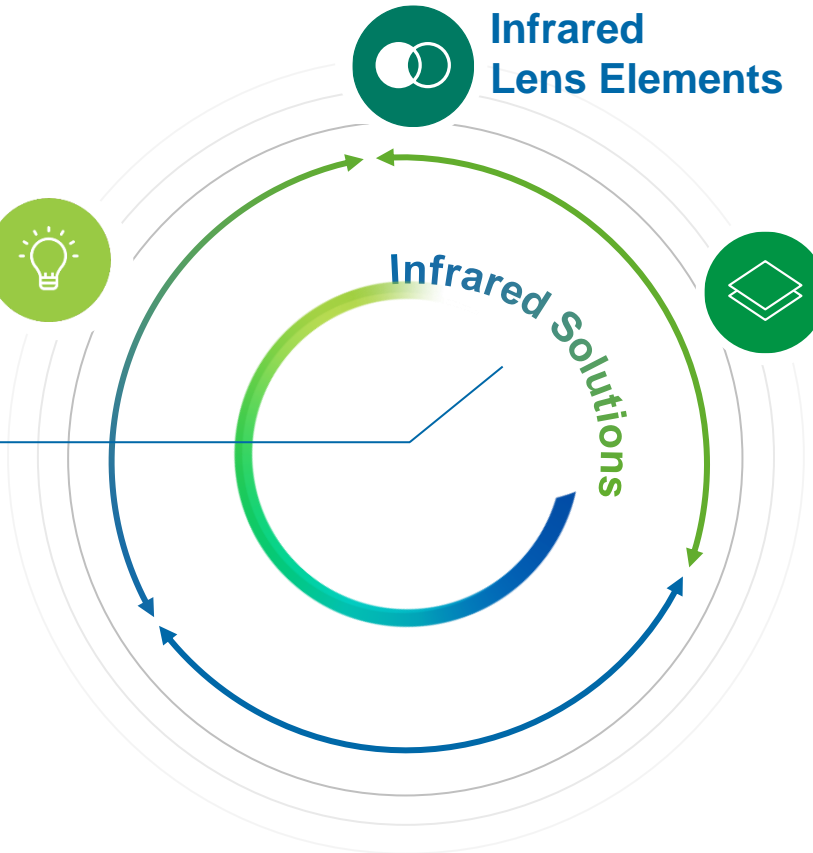
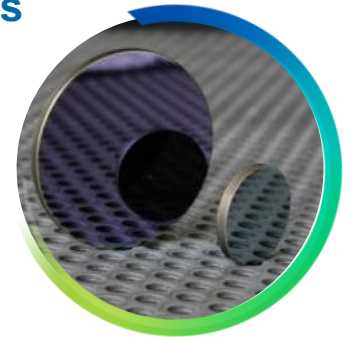
**Innovative  
technologies  
smart optics**



**Infrared  
Lens Elements**



**Infrared  
Coatings**



# EOM geographic presence



## EOM HQ Ge Solutions

- Ge Recycling
- GeCl4
- Ge Substrates

## Olen, Belgium



## Quapaw, OK, USA



## IR Solutions

- IR Optics



## Ge Solutions

- Ge Recycling & GeCl4

## Dundee, Scotland, UK



## IR Solutions

- Thermal imaging coatings
- CO<sub>2</sub> laser coatings
- IR filters

## Acigné, France



## IR Solutions

- Glass and molding
- Design and prototyping
- IR Optics production



## Tokyo, Japan

Sales & Business Dev.



## Seoul, Korea

Sales & Business Dev.



## Shanghai, China

Sales & Business Dev.



## Mumbai, India

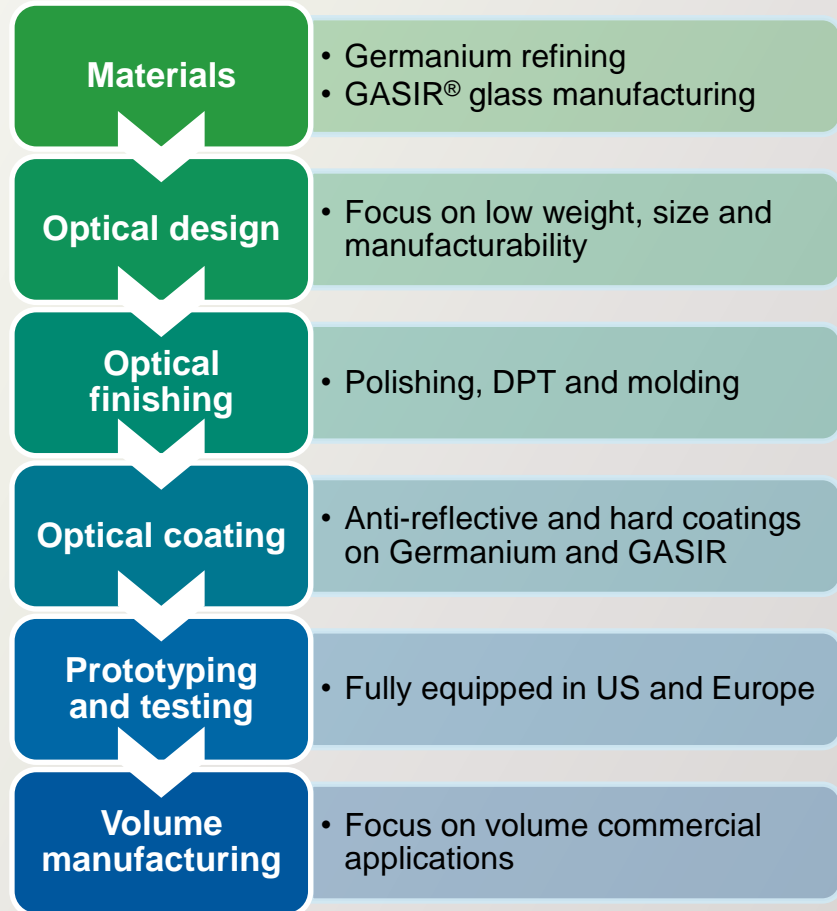
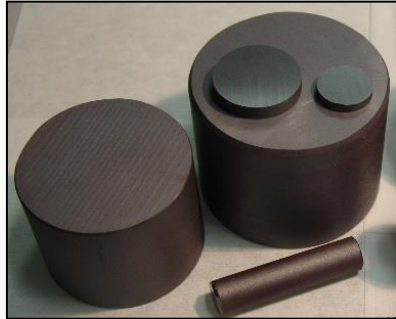
Sales & Business Dev.



## Melbourne, Australia

Sales & Business Dev.

# Optical capabilities and strengths





# Development Drivers and Trends

# From luxury to necessity



# High Volume Applications



Smart Phones

Security & Surveillance



Medical Monitoring



Industrial Thermography

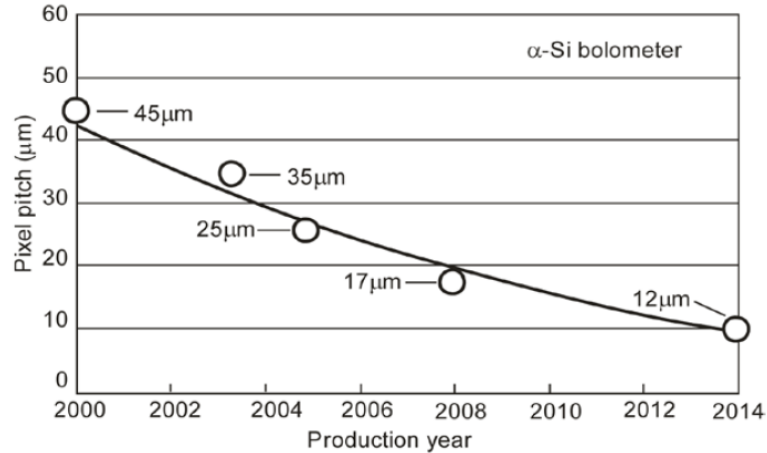


Smart Building

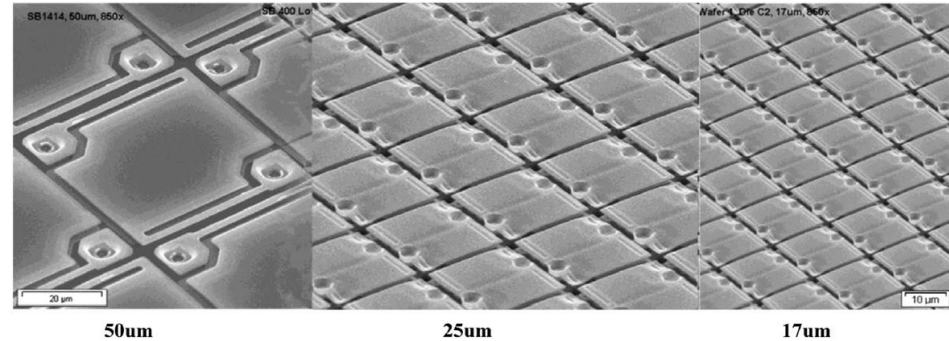
Automotive  
(AEB)



# Detector Pitch



A. Rogalski et al., *Rep. Prog. Phys.* 79 (2016)

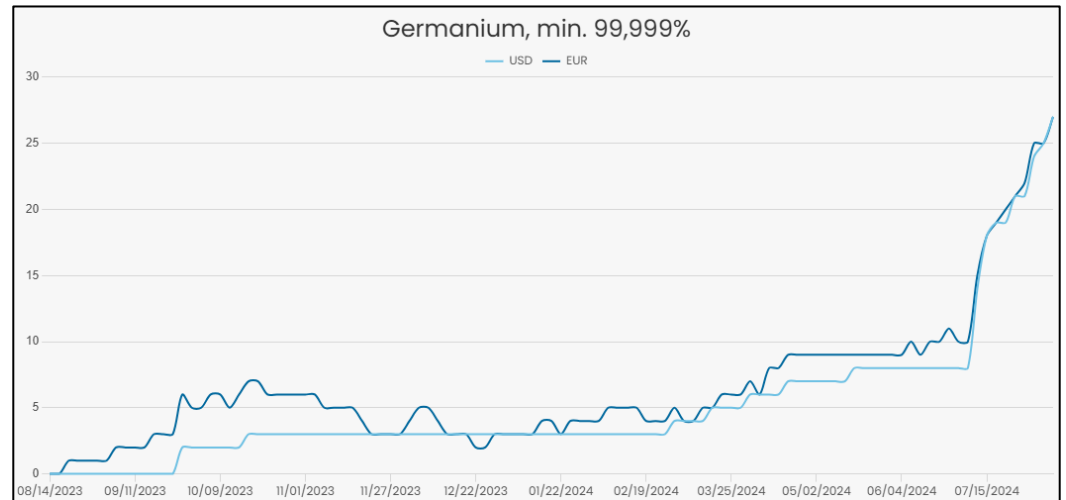
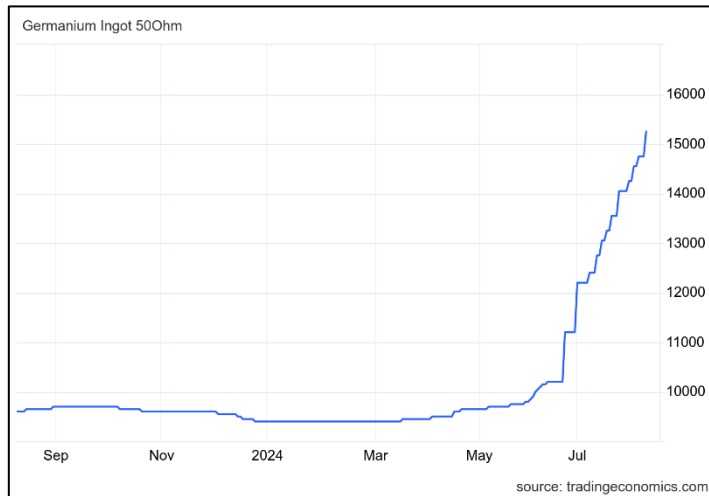


D. Lohrmann et al., *Optical Engineering* 52(6) (2013)

There is a well-documented trend towards smaller pixel pitch

Today both 12μm and 17μm pixels are standard. And 8μm and 10μm are coming.

# Germanium Price



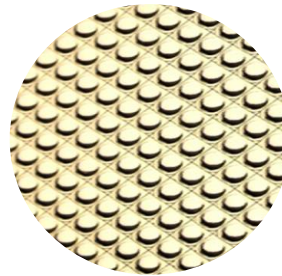
**Tessella™ - Wafer molding  
technology for new sensing and  
consumer markets**

# Tessella™ Product

## Wafer level optics enabling very high-volume thermal imaging

Tessella™ Product is:

- Wafer level lenses
- For use with small detectors
- Very high volume



Technology:

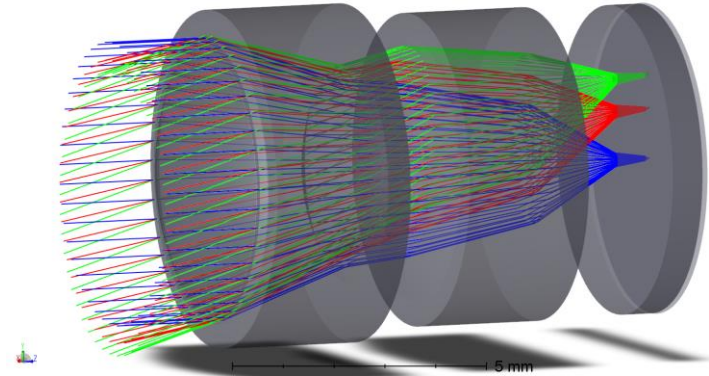
- Unique wafer molding technology
- Integrated production flow
- Material knowhow
- Thin film coating expertise
- Automation

Advantages:

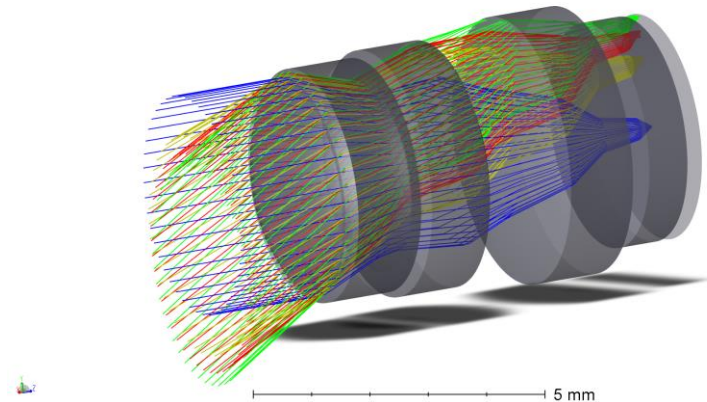
- Maximum utilization of molding machine
  - Highest number of lenses per molding shot
- Reduced coating costs
  - Highest number of lenses in the coating chamber
- Reduced handling costs
  - One wafer handles many lenses

# Beating the limits

- Designed for 10  $\mu\text{m}$  320x240
- Focal Length = 5.7 mm
- f/1.0
- Horizontal FOV 32°
- RI > 85%
- Distortion < 3%



- Designed for 8  $\mu\text{m}$  384x288
- Focal Length = 3.5 mm
- f/0.9
- Horizontal FOV 50°
- RI > 82%
- Distortion < 9%



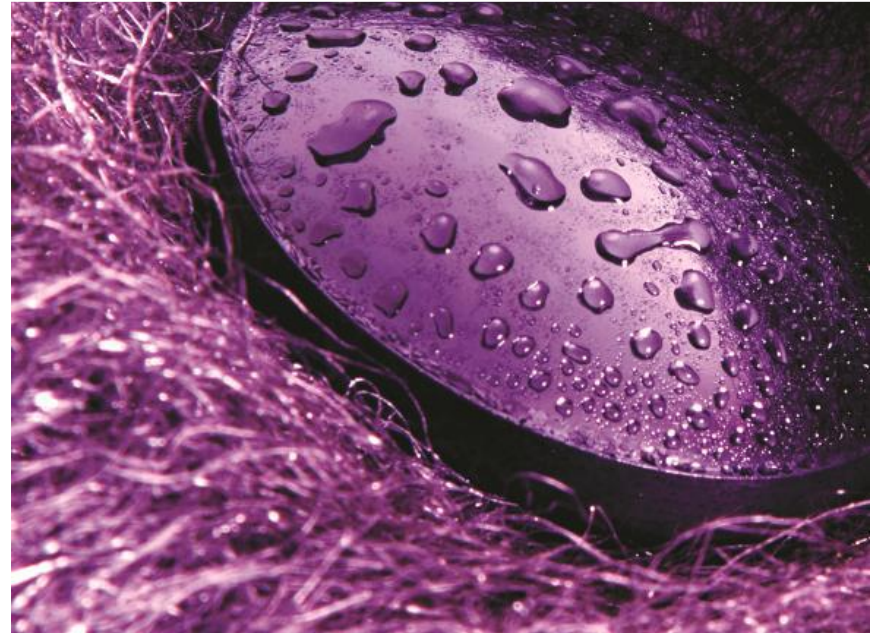


# iDLC – Hard Coating for Chalcogenide lenses

# iDLC<sup>®</sup> on GASIR

## Cost effective replacement of DLC on Germanium

- **iDLC<sup>®</sup> on GASIR meets DLC specifications**
  - Humidity
  - Scratch resistance (windscreen wiper)
  - Salt Fog
- **Proven solution**
  - Launched in 2005
  - More than **1 million iDLC** lenses sold



# Umicore Infrared Optics

## How we differentiate ourselves



### Technology driven

- > **Innovative optical solutions** in GASIR® and other materials to meet demanding performance (SWaP) requirements at competitive conditions
- > **GASIR® molding** (incl Tessella™) and **coating** (incl iDLC™) **process expertise**

- > Proven track record of delivering **high quality** optics
- > **Security of product supply** through our vertically integrated manufacturing including access to raw materials
- > Global footprint to manage geopolitical risks

**Efficient and agile execution for optimized time-to-market**

### Partner with customers to develop high performing solutions

- > **Close collaboration with the customer**, sharing our optics expertise, to optimize product quality and time-to-market

- > Design for manufacturability and optimal cost
- > Solid execution from concept to volume delivery
- > Cross functional support (technical, production & scheduling, quality, sales)

**Optimal 'Total Cost of Ownership'**

# Solutions based on customer needs



## Standard Product Portfolio

- Developed for an easy fit with a wide range of camera cores
- Cost-effective solution for thermal imaging and sensing applications
- Standard mechanical interfaces for easy fit to existing camera housing

## Customized Solutions

- Built-to-Spec: Performance-Cost Optimized Optical Solutions
- Built-to-Print: Intermediary and finished optical elements
- Leveraging our strengths in materials, opto-mechanical design & process expertise and manufacturing know-how

For latest updates please consult: <https://eom.umicore.com/en/infrared-optics/>

Horizontal Field of View for different detectors															
	10 μm		12 μm					17 μm			34 μm				
	640x480	320x240	80x80	1024x768	640x480	320x240	206x156	160x120	80x80	640x480	384x288	320x240	160x120	80x80	
1.5 mm f/1.2	-	-	-	-	-	-	96°	72°	-	-	-	106°	106°		
1.9 mm f/1.3	-	-	-	-	-	-	81°	61°	-	-	-	90°	90°		
3.7 mm f/1.3	-	51°	-	-	-	61°	39°	30°	-	-	-	90°	43°	43°	
3.9 mm f/1.1	-	49°	-	-	-	60°	38°	29°	-	-	-	42°	42°	42°	
5 mm f/1.2	-	36°	-	-	-	43°	28°	22°	-	-	-	62°	31°	31°	
6.2 mm f/1.0	61°	30°	-	-	75°	36°	23°	17.7°	-	-	63°	52°	25°	25°	
6.8 mm f/1.3	-	27°	-	-	-	33°	21°	16.3°	-	-	-	47°	23°	23°	
6.8 mm f/1.4	-	-	-	-	-	-	-	-	-	-	-	47°	23°	23°	
7.2 mm f/1.0	-	25°	7.6°	-	-	30°	19.5°	15.2°	-	-	-	-	21°	21°	
7.5 mm f/1.2	50°	25°	-	-	61°	30°	18.9°	14.7°	-	-	51°	42°	21°	21°	
8.5 mm f/1.2	43°	21°	-	-	51°	26°	16.6°	12.9°	-	73°	44°	36°	18.2°	18.2°	
8.8 mm f/1.0	42°	21°	6.2°	-	50°	25°	16.1°	12.5°	-	-	43°	35°	17.7°	17.7°	
8.9 mm f/1.4	-	-	-	-	-	-	-	-	-	69°	42°	35°	17.4°	17.4°	
9 mm f/1.0	-	20°	-	-	-	24°	15.7°	12.2°	-	-	-	-	17.3°	17.3°	
10 mm f/1.2	36°	17.8°	-	-	44°	21°	13.7°	10.7°	-	-	37°	30°	15.1°	15.1°	
13 mm f/1.1	-	14.3°	-	-	-	17.1°	11.0°	8.6°	-	-	-	-	12.1°	12.1°	
13 mm f/1.0	28°	14.3°	-	-	-	17.1°	11.0°	8.6°	-	-	-	24°	12.1°	12.1°	
14 mm f/1.0 M24	26°	13.2°	4.0°	-	31°	15.9°	10.2°	8.0°	-	-	27°	22°	11.3°	11.3°	
14 mm f/1.2	25.1°	12.6°	-	-	30.1°	15.2°	9.8°	7.7°	-	42.1°	25.7°	21.5°	10.8°	10.8°	
18 mm f/1.0	20.3°	10.2°	-	-	24.3°	12.2°	7.9°	6.1°	-	-	-	17.3°	8.7°	8.7°	
19 mm f/1.0	19.2°	9.7°	-	-	23.0°	11.6°	7.5°	5.8°	-	32.3°	19.6°	16.4°	8.2°	8.2°	
19 mm f/1.2	19.1°	9.7°	-	-	-	11.6°	7.5°	5.8°	-	-	19.4°	16.3°	8.2°	8.2°	
25 mm f/1.0	-	-	-	-	17.6°	8.8°	5.7°	4.4°	-	-	15.0°	12.5°	6.2°	6.2°	
25 mm f/1.2	14.5°	7.3°	-	27.1°	17.3°	8.8°	5.6°	4.4°	-	24.2°	14.8°	12.4°	6.2°	6.2°	
35 mm f/1.1	10.3°	5.2°	-	-	12.2°	6.2°	4.0°	3.1°	-	16.9°	10.5°	8.8°	4.4°	4.4°	
42 mm f/1.0	8.7°	4.4°	-	-	10.4°	5.2°	3.4°	2.6°	1.9°	-	8.8°	7.4°	3.7°	3.7°	
50 mm f/1.0	7.3°	3.7°	-	13.5°	8.7°	4.4°	2.8°	2.2°	-	12.3°	7.4°	6.2°	3.1°	3.1°	
55 mm f/1.1	6.7°	3.4°	-	-	8.0°	4.0°	2.6°	2.0°	-	-	-	5.7°	2.9°	2.9°	
60 mm f/1.25	6.1°	3.1°	-	11.6°	7.3°	3.7°	2.4°	1.8°	-	10.3°	6.2°	5.2°	2.6°	2.6°	
75 mm f/1.1	4.8°	2.4°	-	9.0°	5.8°	2.9°	1.9°	1.5°	-	8.1°	4.9°	4.1°	2.1°	2.1°	
100 mm f/1.5	-	-	-	-	-	-	-	1.1°	-	-	6.2°	3.7°	3.1°	1.6°	1.6°
100 mm f/1.0	3.7°	1.8°	-	7.0°	4.4°	2.2°	1.4°	1.1°	-	6.2°	3.7°	3.1°	1.6°	1.6°	

materials for a better life