BSM SWIR Modular Microscope

Catalogue

1 SWIR Modular Microscopy

The evolution of CMOS sensor technology, driven by demand for compact, high-performance imaging systems under strict size and power constraints, has enabled significant advancements in digital microscopy. Short-wave infrared (SWIR) modular microscopes, exemplified by systems like the ToupTek SWIR microscope, now provide transformative capabilities for industrial and scientific applications by extending imaging beyond the traditional visible spectrum 400–700 nm into the 900–1700 nm range.

SWIR modular microscopy bridges the gap between conventional optical systems and specialized IR imaging, offering unparalleled precision for next-generation material and electronic inspection.

1.1 Technical Features

1. Optical Compatibility: SWIR microscopy leverages standard glass lens systems, avoiding the need for reflective optics required in mid-wave (MWIR) and long-wave infrared (LWIR) imaging. This compatibility allows seamless integration with conventional microscope platforms, reducing retrofitting costs.
2. Silicon Penetration Capability: SWIR photons, with energy below silicon's bandgap (1.1 eV), enable non-destructive inspection of internal defects in silicon-based materials, such as microcracks in semiconductor wafers or soldering failures in electronic components.
3. Modular Architecture
   - **Illumination Module**: Combine IR LEDs optimized for SWIR wavelengths, ensuring uniform sample illumination.
   - **Imaging Module**: High-sensitivity sensors and refined optical paths with large NA achieve micron-level resolution and small depth of field. With the Utilizes high-sensitivity InGaAs sensors (e.g., SWIR5000KM series camera) to achieve micron-level resolution. The camera's compact design (80 × 80 × 45.5 mm^3) and dual-gain mode enhance adaptability for high-speed (up to 35.5fps(USB3),93fps(CL),118fps(10G)) and low-noise imaging.
   - **Mechanical Module**: Features a precision CNC machining with anti-vibration design for stability in automated or high-throughput workflows.

1.2 Application Fields

1. **Semiconductor Manufacturing**: Detecting subsurface defects in silicon wafers and chip interconnects.
2. **Materials Science**: Identifying invisible cracks in ceramics or composite materials.
3. **Industrial Inspection**: Analyzing subsurface structures in components without destructive disassembly.

1.3 Advantages

1. **Enhanced Material Contrast**: SWIR wavelengths improve visibility of features obscured in visible light.
2. **Cost Efficiency**: Utilizes existing microscope optics and affordable tungsten/LED illumination.
3. **Scalability**: Modular designs enable customization for specific wavelengths, sensors, or automation needs.

2 BSM System Parameters

2.1 BSM-T100VA

- Support high NA infinity SWIR microscope objectives ;
- The focal length of tube lens: 100mm;
- Field Number: 33mm (Using 200mm focal length tube lens);
- Wavelength: 900-1700nm;
- Camera interface: C;
- Illumination: Coaxial Kohler Lighting;
- Lighting source: 1550/1400/1300/1200nm LED;

2.2 BSM-T180VB

- Support infinity SWIR microscope objectives;
- The focal length of tube lens: 180mm;
- Field Number: 24mm (Using 180mm focal length tube lens);
- Wavelength: 900-1700nm;
- Camera interface: C;
- Illumination: Coaxial Kohler Lighting;
- Lighting source: 1550/1400/1300/1200nm LED;

2.3 BSM-T090VA(Customized)

- Support high NA infinity SWIR microscope objectives ;
- The focal length of tube lens: 90mm;
- Field Number: 33mm (Using 200mm focal length tube lens);
- Wavelength: 900-1700nm;
- Camera interface: C;
- Illumination: Coaxial Kohler Lighting;
- Lighting source: 1550/1400/1300/1200nm LED;

2.4 BSM-T110VA(Customized)

- Support high NA infinity SWIR microscope objectives ;
- The focal length of tube lens: 110mm;
- Field Number: 33mm (Using 200mm focal length tube lens);
- Wavelength: 900-1700nm;
- Camera interface: C;
- Illumination: Coaxial Kohler Lighting;
- Lighting source: 1550/1400/1300/1200nm LED;

3 Objective Parameters

Order Number	NA	Work Distance (mm)	Focal Length (mm)	Resolution (um)	Depth of Focus ±D.F.(um)	FN (mm)	Weight (g)
M PLAN APO NIR 5X	0.14	37.5	40	2.0	14	24	220
M PLAN APO NIR 10X	0.26	30.5	20	1.1	4.1	24	250
M PLAN APO NIR 20X	0.4	20	10	0.7	1.7	24	300
M PLAN APO NIR 50X	0.42	17	4	0.7	1.6	24	315
M PLAN APO NIR 50X HR	0.65	10	4	0.4	0.7	24	450

4 SWIR Camera Series for BSM

Model Number	Image Sensor	Pixel Size (um)	Dynamic Range SNR	Data Interface	FPS/Resolution 8bit	Binning	Exposure Time Dimension
SWIR5000KMA	5.0M/IMX992(M,GS) 1/1.4”(8.94x7.09) Built-in TEC	3.45x3.45	51.5dB 48.5dB	USB3	61.9@2560x2048 135.7@1280x1024	1x1 1x1	15us~60s 80mm
SWIR3000KMA	3.0M/IMX993(M,GS) 1/1.8”(7.07x5.3) Built-in TEC	3.45x3.45	51.5dB 48.5dB	USB3	93@2048x1536 176@1024x768	1x1 1x1	15us~60s 80mm
SWIR1300KMA	1.3M/IMX990(M,GS) 1/2”(6.40x5.12) Built-in TEC	5x5	58.7dB 52.6dB	USB3	200@1280x1024 392@640x512	1x1 1x1	15us~60s 80mm
SWIR330KMA	0.33M/IMX991(M,GS) 1/4”(3.20x2.56) Built-in TEC	5x5	58.7dB 52.6dB	USB3	400@640x512 753@320x256	1x1 1x1	15us~60s 80mm

For more information about SWIR cameras, please visit: SWIR Series Industrial Camera | sCMOS, CMOS & Machine Vision - ToupTek Photonics | ToupTek

5 Dimension

5.1 BSM-T100VA

Figure 1 BSM-T100VA SWIR Microscopy System

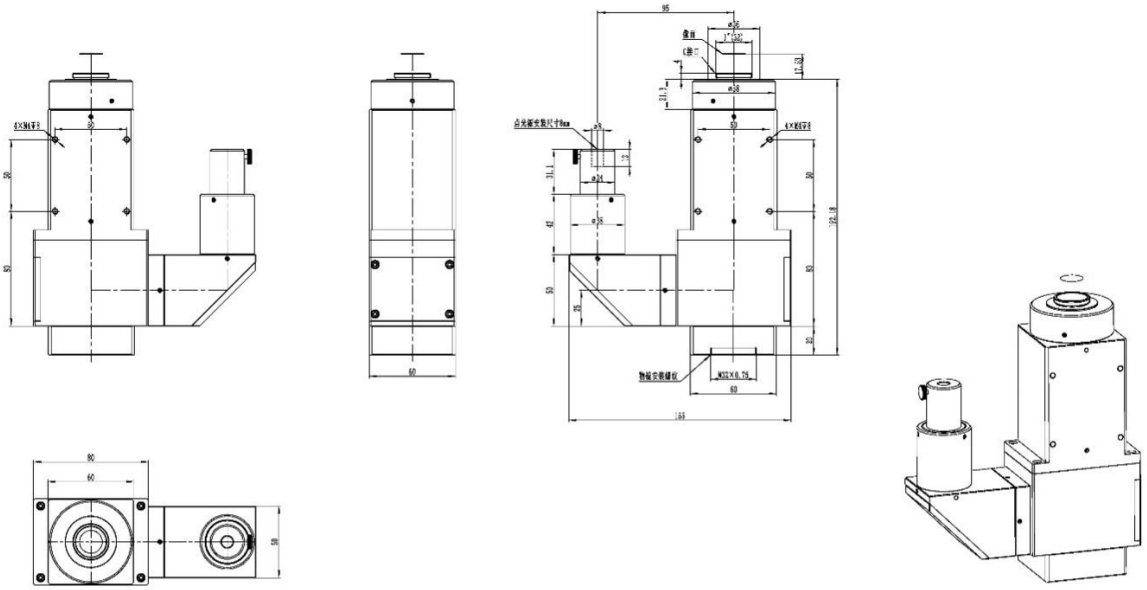

Figure 2 Dimension of BSM-T100VA

5.2 BSM-T180VB

Figure 3 BSM-T180VB SWIR Microscopy System

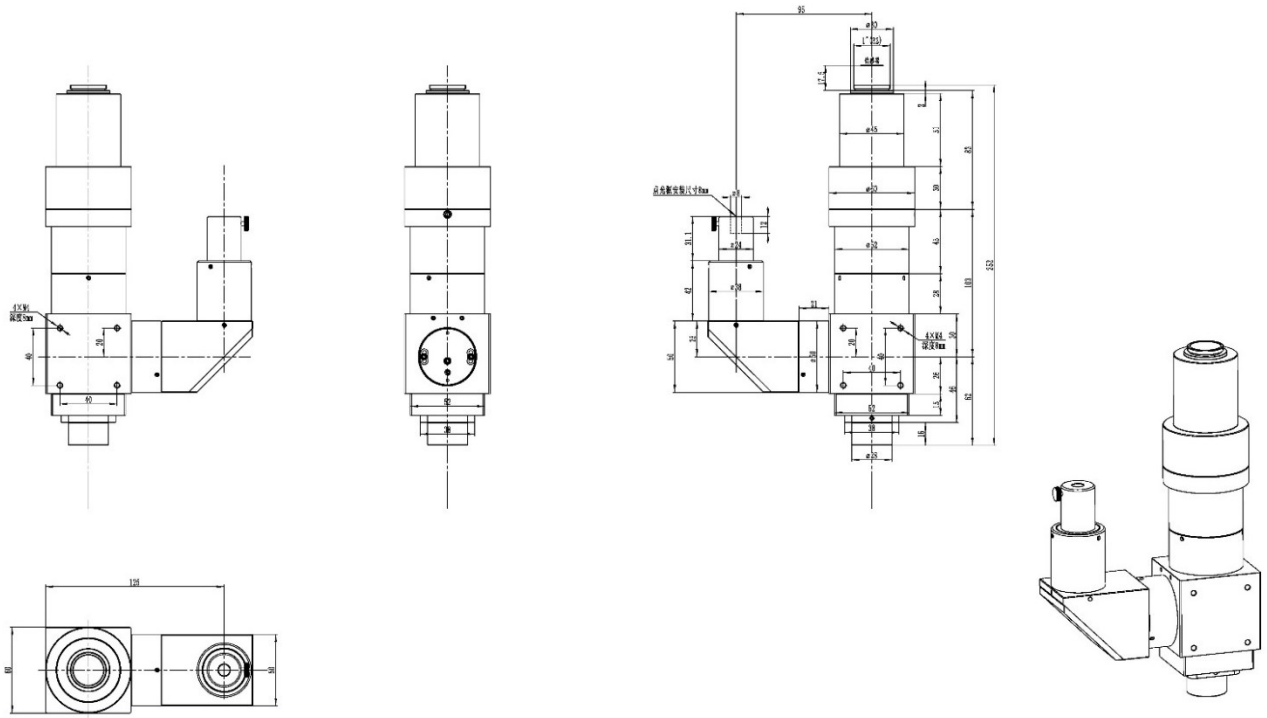

Figure 4 Dimension of BSM-T180VB

6 Application

6.1 Chip Detection

Figure 5 shows the hidden crack image of a silicon-based chip captured by the BSM-T090VA SWIR microscopy system (With 10X infinity SWIR microscope objective and SWIR5000KMA SWIR camera).

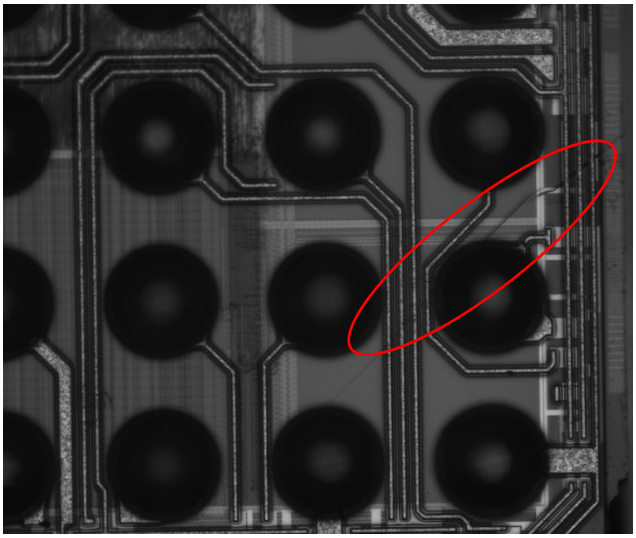

Figure 5 Chip Hidden Crack

6.2 Ceramic Hidden Crack Detection

Figure 6 shows the ceramic hidden crack image captured by the BSM-T090VA SWIR microscopy system (With 10X infinity SWIR microscope objective and SWIR5000KMA SWIR camera).

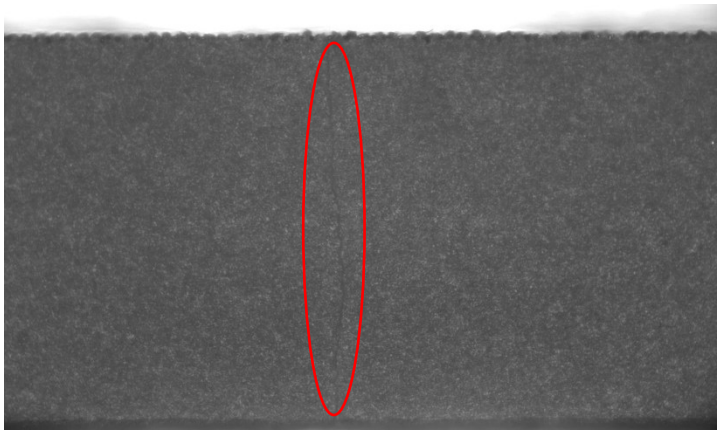

Figure 6 Hidden Cracks in Ceramics

7 Contact Information

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