OPTOSKY
Spectroscopy Solutions

Datasheet

Hyperspectral Imaging Microscope | ATH5010

Features:

- Multiple spectral ranges available
- High spectral resolution, up to 1.3nm
- High number of spatial channels, up to 2048
- High spatial resolution, up to approximately 10μm
- Objective magnification
  - Standard ： 5×, 10×, 20×
  - Optional：40×, 100×
- 5-megapixel visible light camera, with optional cooled high-performance camera
- Highly stable, high-blue-output halogen lamp
- Long-life halogen illumination source, multiple light source options available
- Upright configuration, with inverted configuration optional, compatible with various microscopes
- Bright-field and dark-field scattering microscope systems optional

Application:

- Medical Institute, Cancer tissue sorting, blood cell categories
- Research institute, Universities and colleges
- Pharmaceutical companies, Chinese medicine fake or true
- Food Safety, Meat origin ID
- Micro plastics identification
- Minerals sorting
- Forensic identification, Documents identification
- Biological science, bacteria, cell analysis
- material science, micro materials detection
- Uniformity analysis of LED luminescence surface

Description:

The ATH5010 is a compact, high-definition, and high-quality micro hyperspectral imager launched by Optosky. Its primary function is to scan fine samples to obtain reflectance/transmittance curves of different areas. It consists of a high-magnification microscope, a hyperspectral imager, and a data processing workstation.

The ATH5010 employs a 1920×1024-pixel (up to 2048×2048-pixel) hyperspectral imaging sensor, delivering clear images with minimal noise. It features a highly stable, high-blue, high-infrared, long-life halogen illumination source with a coaxial design, making it extremely user-friendly and requiring minimal maintenance, such as prolonged periods without the need for light source replacement. Additionally, the ATH5010 can integrate Raman spectroscopy, fluorescence spectroscopy, and other techniques to expand its applications.

Utilizing imaging spectroscopy technology, the ATH5010 enables rapid, accurate, and high spectral and spatial resolution imaging of samples. It is highly versatile and suitable for research in medicine, pathology, pharmaceuticals, and life sciences. This makes it an ideal experimental research equipment for medical institutions, research organizations, medical colleges, and pharmaceutical companies.

Model	Feature
ATH5010	Upright Microscope，400~1000nm
ATH5010-17	Upright Microscope，900~1700nm
ATH5010	Built-in Push-broom Micro Hyperspectral Imager
ATH5010-4-17	Upright Microscope，400~1700nm
ATH5010-4-25	Upright Microscope，400~2500nm

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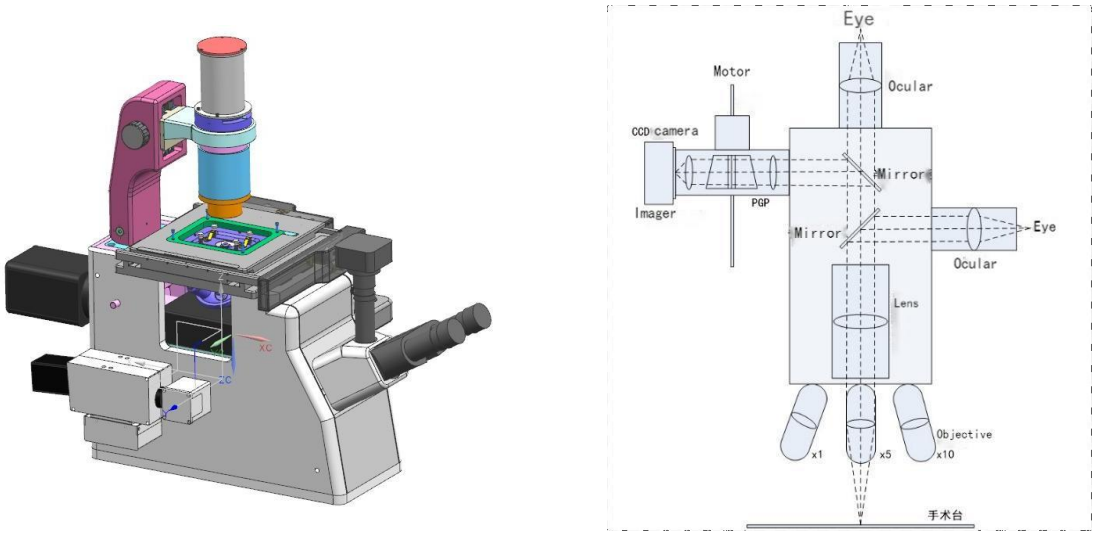

Fig 1 Hyperspectral imaging system structure and optical path principle

This is the principle of hyperspectral imager, the target object to be detected on the operation table going through objectives and microscope lens sets, then being divided into three optical paths, the first path is used for reviewing by chief surgery, the second path is used for reviewing by the assistant, the third path is used for collection by hyperspectral imager, which is driven by motor to perform spatial scanning on the target, after obtaining the spectral imaging information to process the database to be displayed to the chief surgery.

1. Technical Specification

Parameters	ATH5010	ATH5010SCM	ATH5010-17	ATH5010-25
Detector	CMOS	Cooled sCMOS	InGaAs Detector	Deep-cooled Mercury Cadmium Telluride (MCT) Detector
Number of Spectral Channels	1920	2048	640	640
Number of Spatial Channels	1200	2048	512	512
Native Detector Resolution	1920 × 1200	2048*2048	640 X 512	640 X 512
Native Detector Pixel Size	5.86 μm x 5.86 μm	6.5x6.5μm	15*15μm	15*15μm
Detector Interface	USB3.0			
Pixel Bit Depth	12 bits	16 bits	14 bits	14bits
Detector Target Size	11.3 mm ×7.03 mm	13.31x 13.31 mm	9.6 x 7.68 mm	9.6 x 7.68 mm
Field of View (FOV)	11.4°@f=35 mm	21°@f=35 mm	15.2°@f=35mm	15.2°@f=35mm

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Instantaneous Field of View (IFOV)	0.167mrad @f=35 mm	0.85mrad @f=35 mm	0.42mrad @f=35mm	0.42mrad @f=35mm
Maximum Frame Rate	164 fps	72fps	80fps	60 fps
Dimensions	480×300×300mm	480×320×320mm	480×320×320mm	480×350×350mm

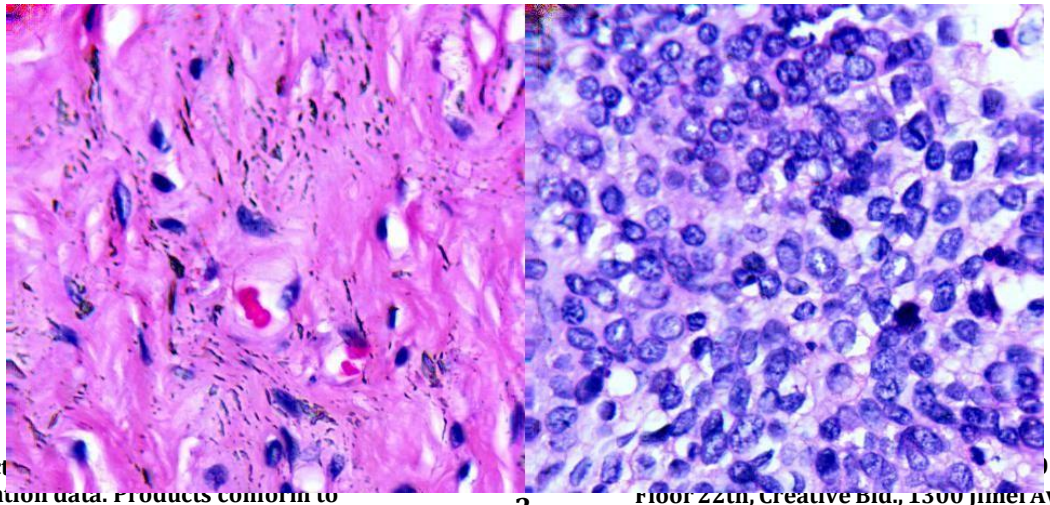
2. Accessories:

S/N	Items	Qty
1	Hyperspectral Microscope Host	1
2	Infinity plan achromatic objective, standard: 5X, 10X, 20x;	1
3	USB flash drive 32G	1
4	Standard Calibration Board	1
5	Power cable 1m	1

3. Application Case

3.1 Tumor tissue detection

Hyperspectral imaging microscope integrates 2D spatial pictures to 1D spectral signal to form 3D cubic database. By combining spectral and imaging technology, hyperspectral images reveal how materials or its molecule in electromagnetic wave absorb and reflect the lights. It not only includes rich spatial information, but also includes spectral features in the continuous narrow wavelength range. It can accurately identify blooded cells. At present, hyperspectral imaging microscope technology has been widely applied to Tongue tumors, intestinal ischemia and cancer, hemorrhagic shock, medical food safety and other diagnostic detection.



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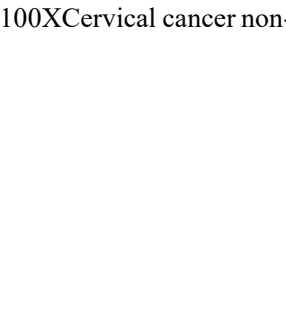
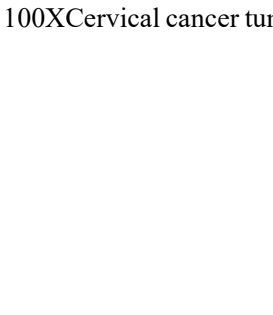
100XCervical cancer non-tumor section



100XCervical cancer tumor section



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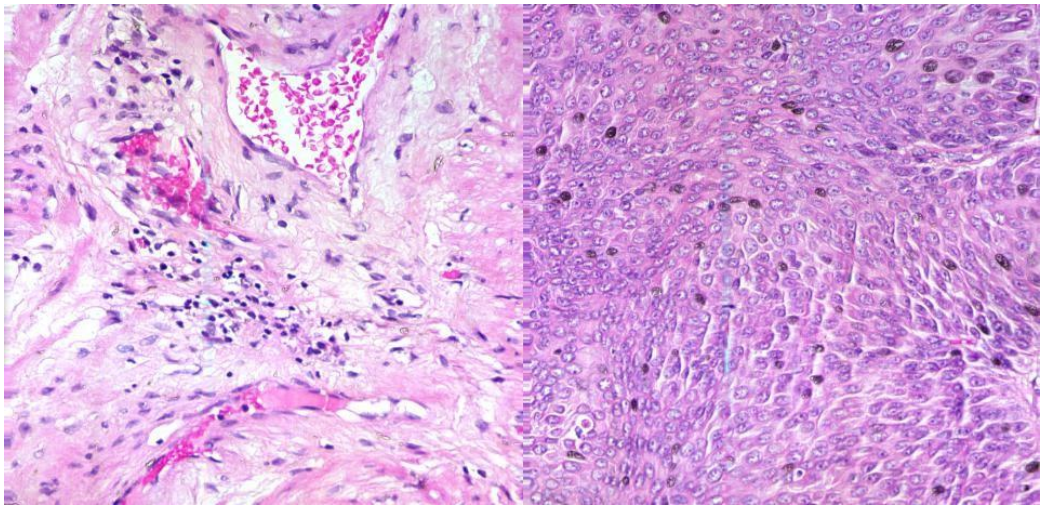
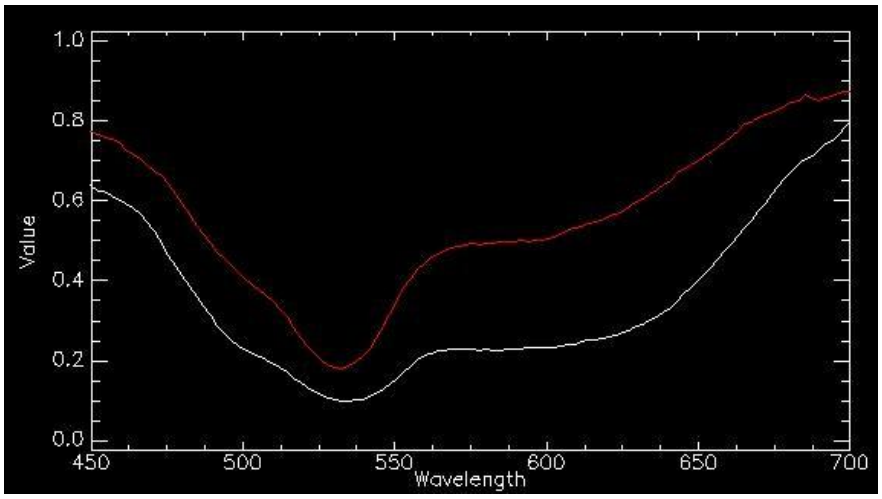


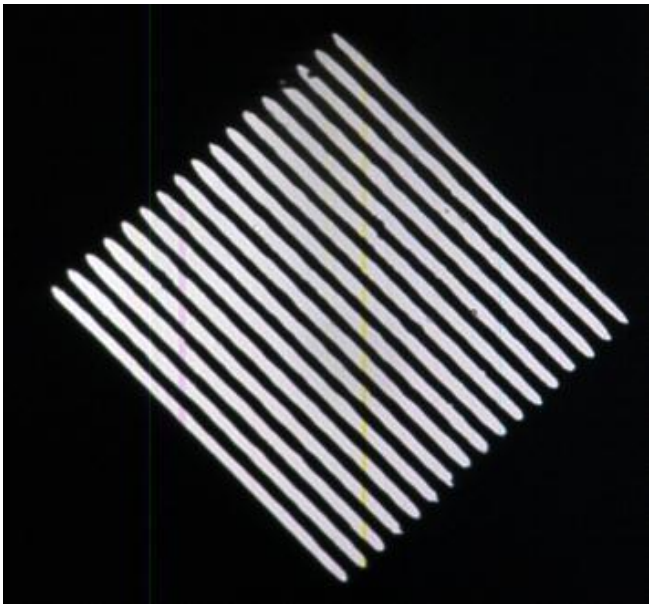
40Xbladder cancer non-tumor section　　40X bladder cancer tumor section



White—Non-tumor

Red—Tumor

cell nucleus spectrum average value



40Xresolution（2.5micron）

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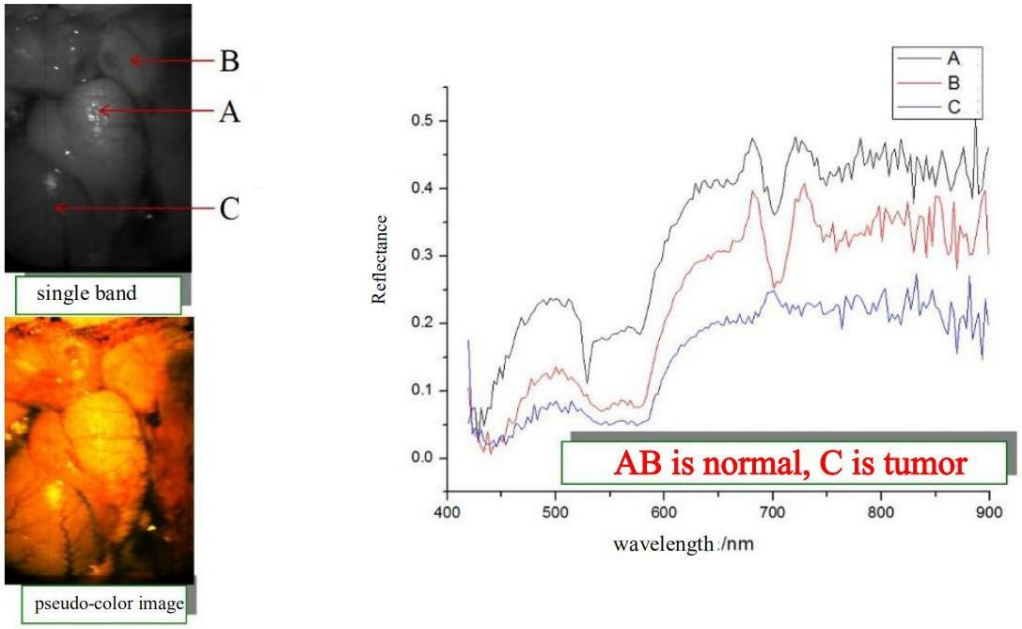

Hyperspectral Imaging Data

Cholangiocarcinoma is a relatively rare but extremely malignant tumor. Because the early symptoms are not obvious, patients often miss the best time for treatment when they find it. As the "gold standard" for the diagnosis of cholangiocarcinoma, pathological diagnosis is mainly performed by experienced physicians on pathological slices with tedious and time-consuming microscopy. In this process, misdiagnosis or missed diagnosis may be caused due to inexperienced physicians in reading films or different evaluation criteria . As an emerging technology, hyperspectral imaging technology can simultaneously obtain spatial and spectral information of samples to be collected. Duan Yipan and others at East China Normal University have done more in-depth research.

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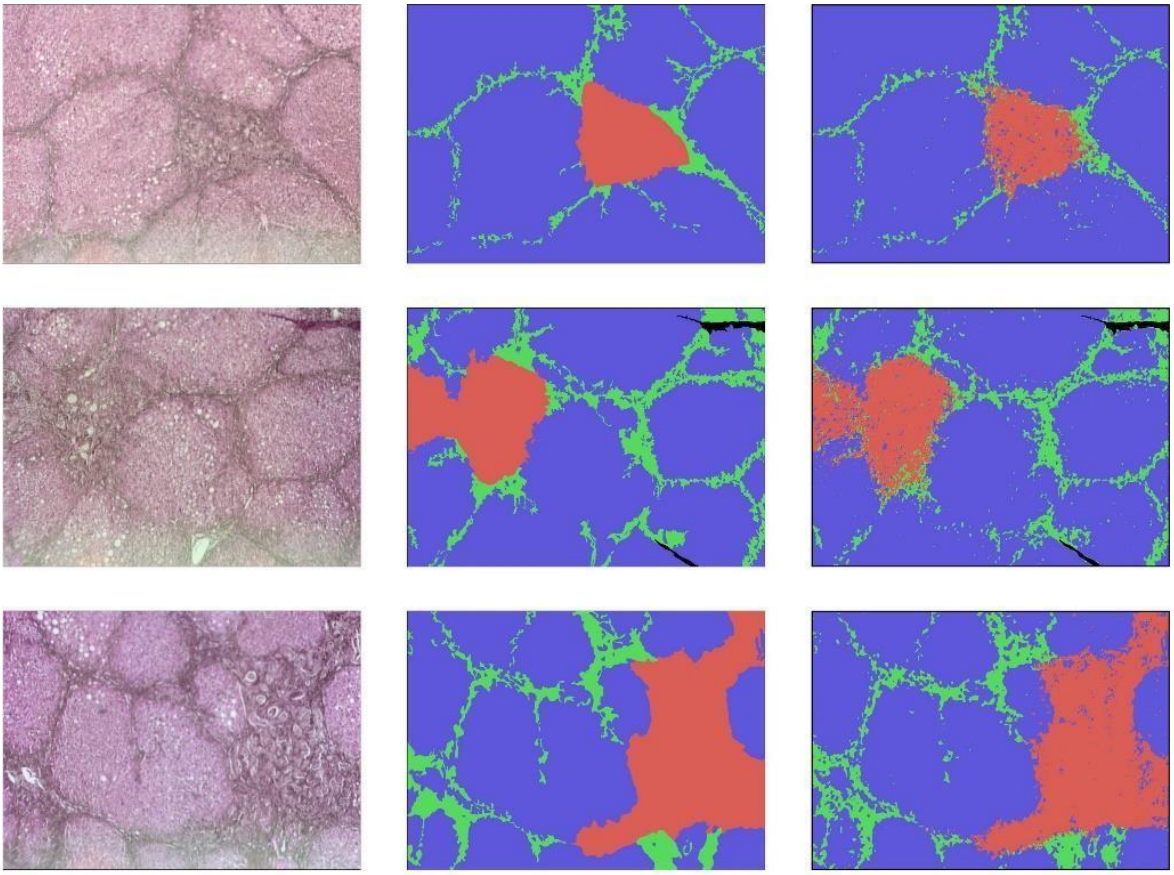

Fig 6 The results of recognition of cholangiocarcinoma tissue by Duan Yipan et al. with hyperspectral imaging microscope (a) pseudo-color composite image (b) manual annotation of the corresponding image (c) 3D-Res-CNN region of the corresponding image Recognition result

3.2 Hyperspectral Microscope Applied To Blood Cell

Blood cell classification plays a huge role in diagnostics. For example, the recognition of cell profile is associated with a specific disease, and the count of white blood cells has been shown to be associated with a variety of diseases, including obesity, smoking, allergic asthma, etc. Initially, blood cell classification and counting were performed manually under a microscope, which was time-consuming and had a high error rate. Automatic blood cell classification can be realized with digital microscopic imaging technology. Due to the similar shapes of different types of blood cells, the accuracy and specificity of cell classification still pose challenges to traditional microscopic imaging techniques. Medical hyperspectral images combine two-dimensional spatial images and one-dimensional spectral signals into a three-dimensional data cube. Combining spectroscopy and imaging technology, the essence of medical hyperspectral images is to reflect materials and how they absorb and reflect light under molecular-level electromagnetic waves. It not only includes rich spatial information, but also contains many continuous narrow bands called spectral features, which can accurately distinguish different blood cells. At

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present, medical hyperspectral imaging technology has been applied to the detection of tongue tumors, intestinal ischemia and cancer, hemorrhagic shock, medical food safety and other diagnostics.

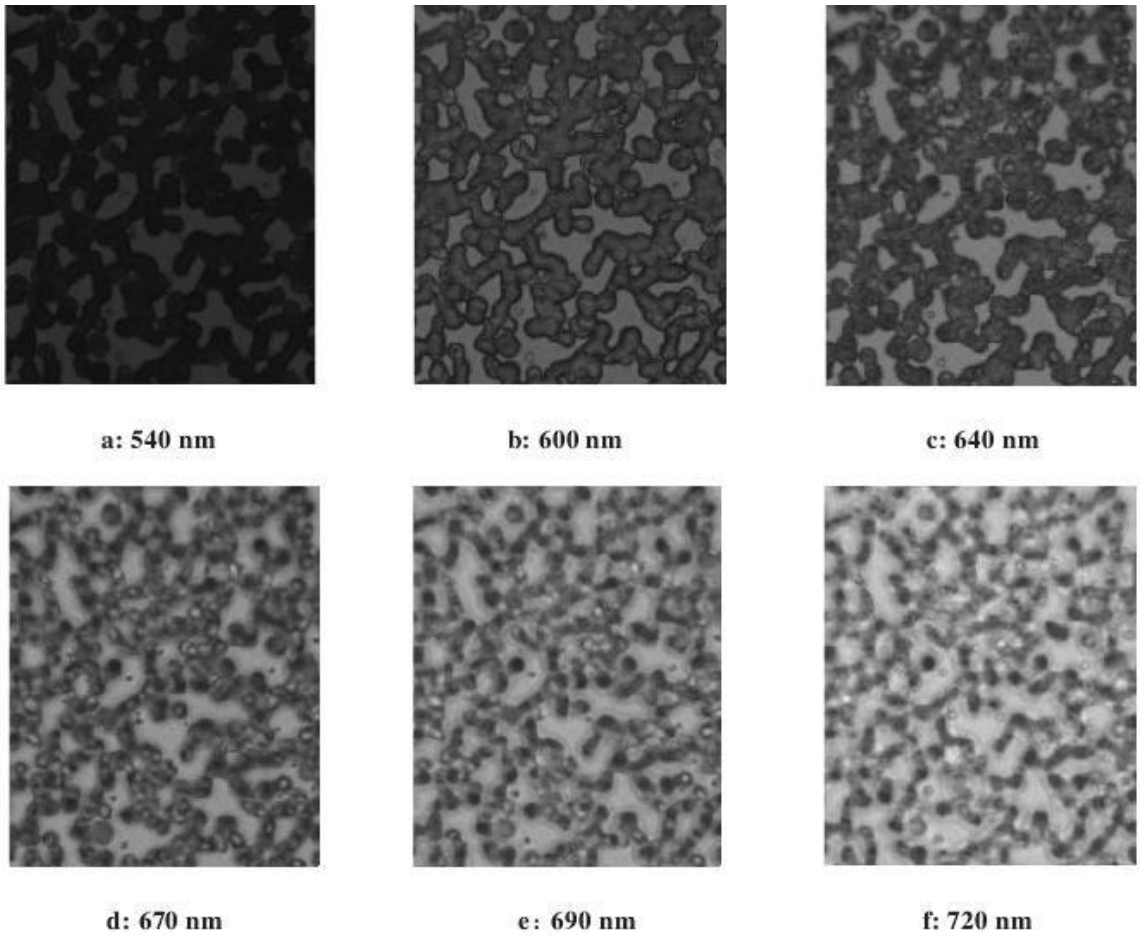

Fig 1 Hyperspectral Microscope images in different bands

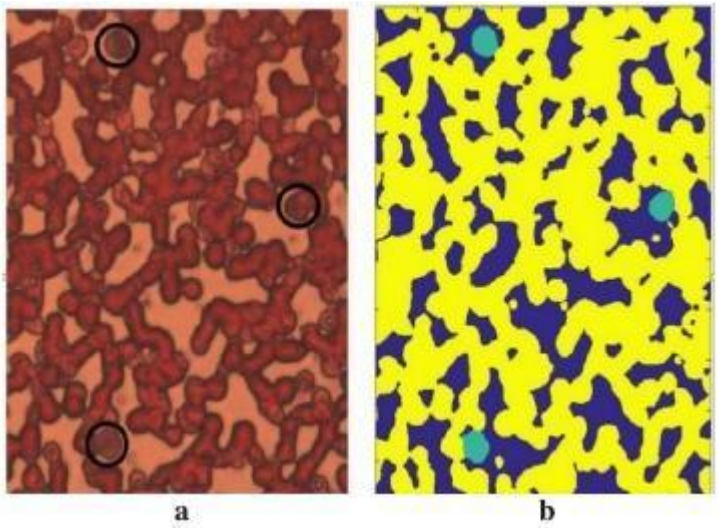

Fig 2 (a)Background, White and Red cell pseudo-color images(b) distribution

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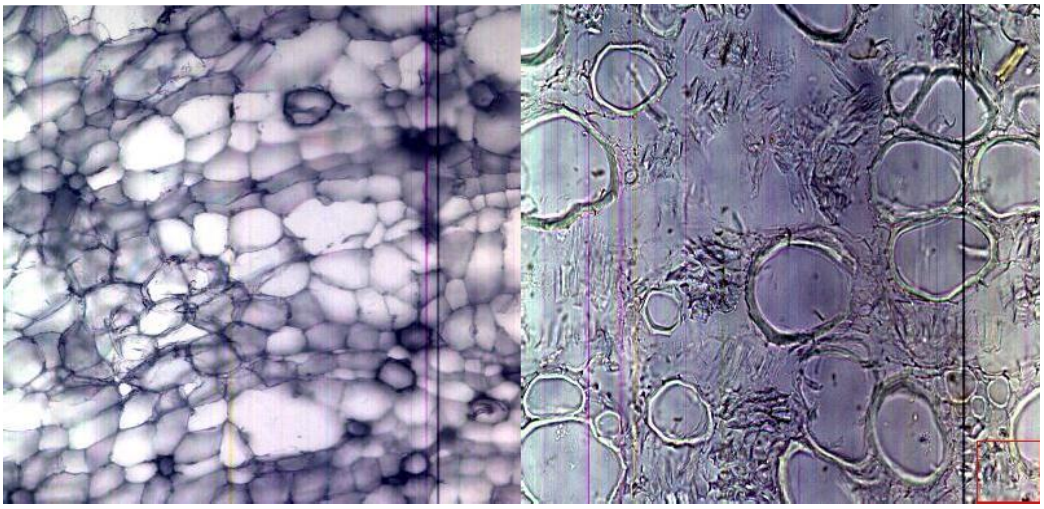
3.3 Hyperspectral Microscope Applied To Chinese Traditional Medical Materials



40X fresh Chinese angelica frozen section　　40X dewaxing Astragalus section

3.4 Hyperspectral Microscope Applied to Wood Species Classification

In wood trading activities, the identification of wood species and the determination of species grades have always been a difficult task that requires practical experience. The properties, physical properties and prices of different species of wood vary greatly. Hyperspectral imaging has the advantages of multiple bands, high resolution and integration of spectrum and maps. It integrates spectral and spatial information and has been applied in the field of remote remote sensing classification and sample tissue composition detection. Zhao Peng and others of Northeast Forestry University used hyperspectral microscope and Composite Kernel SVM function algorithm to achieve a classification accuracy of about 95%.

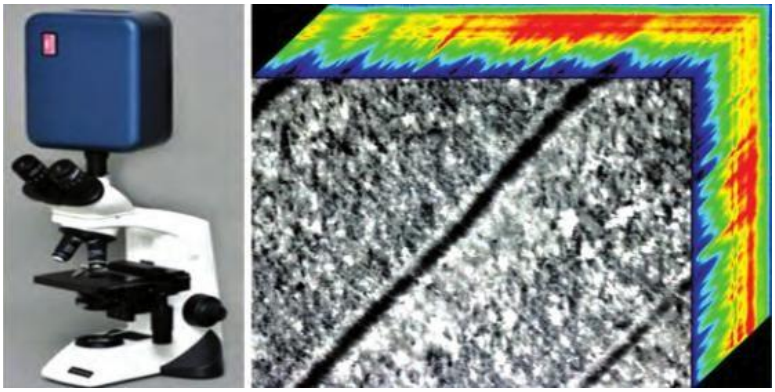


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Fig 3 Hyperspectral Microscope System；(a)：Hyperspectral Imager；(b)：Hyperspectral cubic images database（Merbau wood in Indonesia）

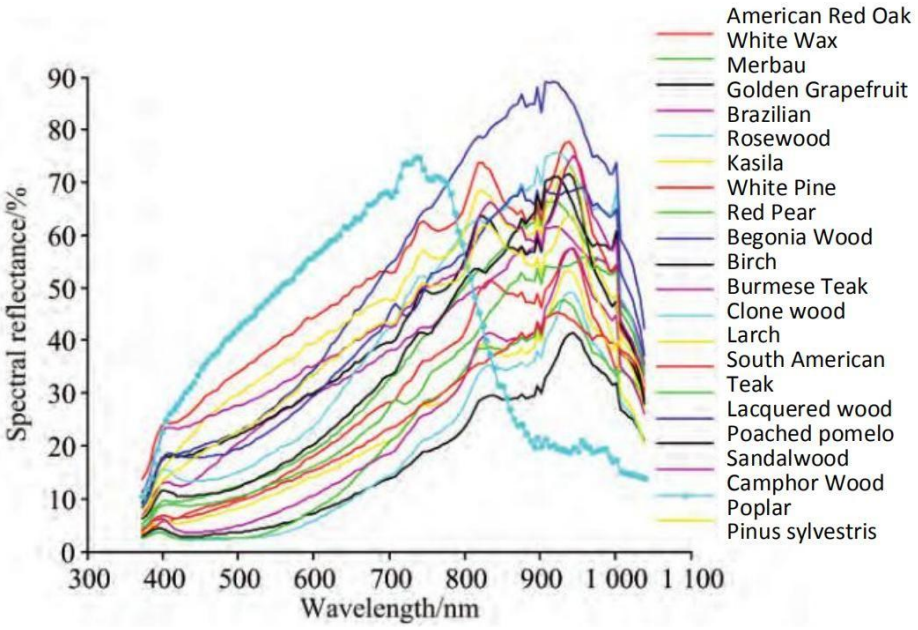

Fig 4 20 classes of woods specimen average spectral curves

3.5 Hyperspectral Microscope Applied to LED 2D Joint Temperature Detection

With the rapid development of LEDs, thermal management has always been the focus of research. The highest temperature part of LED devices is the P-N junction. Excessive junction temperature will seriously affect the performance of the LED, and even cause damage to the LED. Since the surface of the LED is usually covered by a package, temperature measurement can only be achieved by non-contact means. The Lu Yijun research group of Xiamen University innovatively uses microscopic hyperspectral scanning to detect the two-dimensional junction temperature of LEDs. The microscopic hyperspectral can realize non-contact measurement without changing the working state of the LED itself. The sample to be tested is irradiated with incident light and the reflected light is collected. The test can be completed without directly contacting the LED sample to be tested. For bare LED chips with small surface area and fragile chip structure, direct contact with easily damaged chips, this method danger is avoided, and junction temperature testing can be performed on chips with transparent packages.

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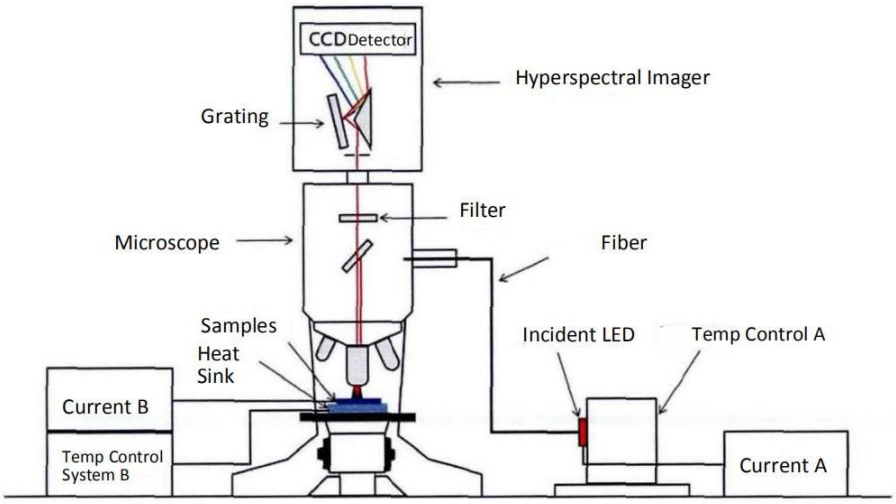

Fig 3-9 Hyperspectral Microscope Joint Temperature Lab Setup figure

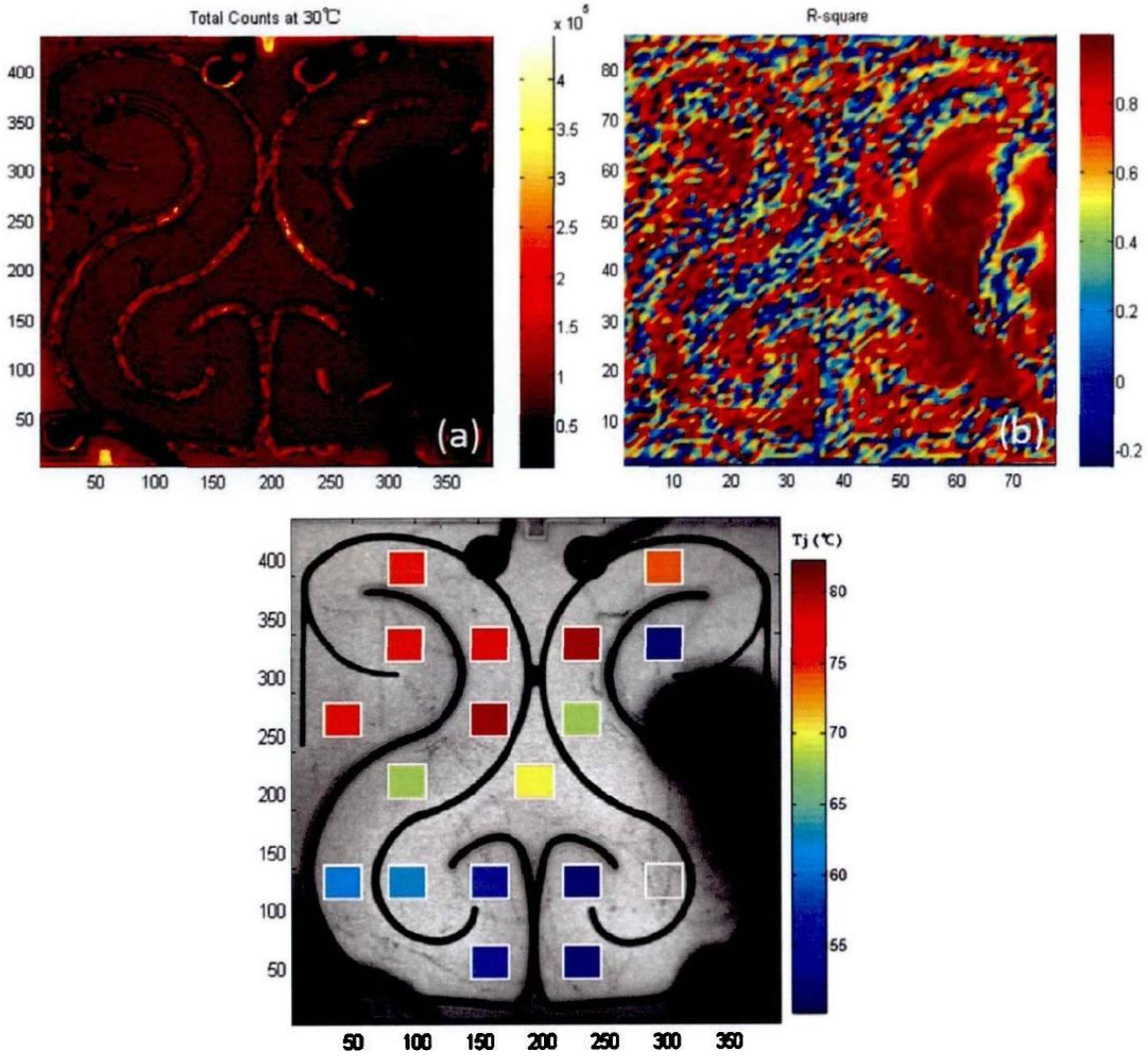

Fig 5 The Lu Yijun research group of Xiamen University measure LED 2D joint temp (500mA temperature distribution condition)
2.5 μm resolution (40XObjective)

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