

## Hyperspectral Imaging Microscope

## ATH5500-17

### Features:

- Spectral Range: 1000-1700nm
- Spectral Resolution: <35
- Customized version of infrared high transmittance microscope system;
- Objective lens magnification:  
Standard: 4X, 10X, 20X;  
Optional: 40X, 100X

### 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

### Description:

ATH5500-17 is self-developed hyperspectral imaging microscope with compact size, HD, high quality, it consists of microscope, hyperspectral imager and data processing work station.

ATH5500-17 employs 1920X1080 pixels high performance CCD imaging component, clear images, low noise, the integrated exclusive high compression images algorithm can improve database storage.

Hyperspectral imaging technology provides spectral images with fast, accurate, and high spectral and spatial resolution, and universality. It can widely applied to medicine, pathology, pharmaceutical, life science etc. As well as medical institute, research science, medical college, pharmaceutical companies laboratory research equipment.

Models	Features
ATH5500-17	Upright Microscope
ATH5500INV-17	Inverted Microscope
ATH5500OPN-17	Scientific-grade



ATH5010 Lab Hyperspectral imaging system; (a) ATH5010INV; (b) ATH5010INV; (c) ATH5010

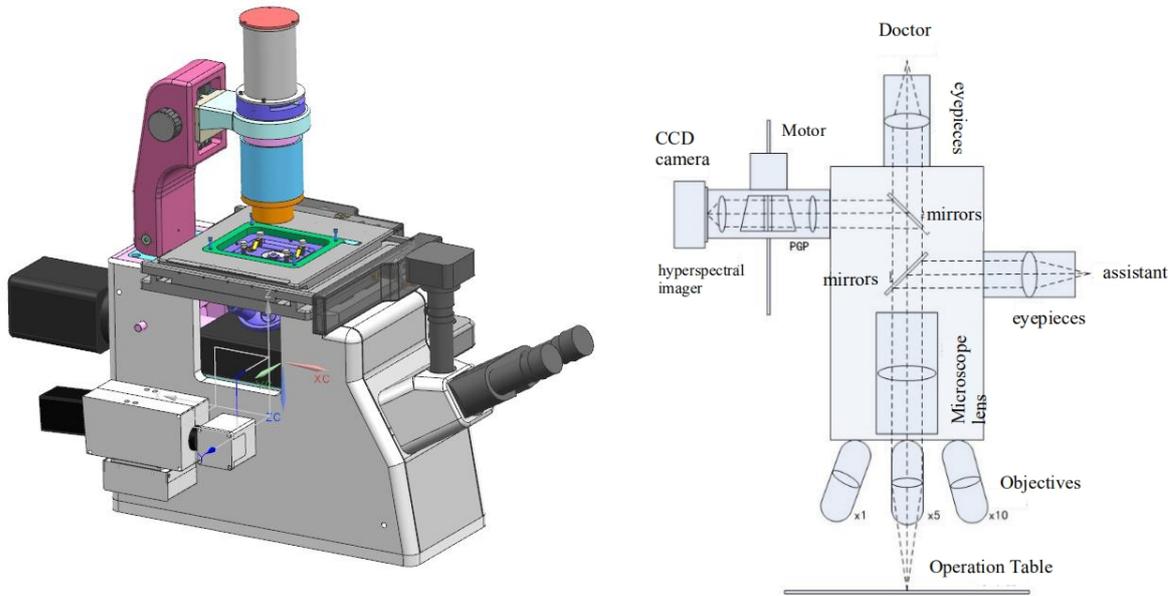


Fig1: Hyperspectral imaging system structure and optical path

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

### 1. Imaging Spectrometer Module

Spectral Range	1000-1700nm
Spectral Resolution	<35nm
Spectral Channels	270 (Max. 1024)
Spatial Pixels	480 (Max. 2048)
A/D	12bit
FOV Overlap	Shift < 10% of FOV diameter of microscope
Cleanliness	No obvious pitting, scratches, bubbles and other defects that obviously affect the observation in the field of view, and no obvious broken edges, oil stains and attachments of optical parts
Equipment inclined degree	Normal work < 10°

Stability	Stable and firm stand support, movement, moving parts
Voltage	100-220V, ±10%
EMC Test	Pass
Temperature	+10°C~+40°C
Humidity	30%~75%
Air Pressure	700hPa~1060hPa

## (2) Microscope Module

Optical System	Infinite chromatic aberration-corrected optical system/common-corrected optical system
Observer head	Siedentopf type binocular or trinocular head, 30°inclined, Interpupillary: 50-75mm
Eyepieces	PL10X/22mm High eye-point wide field plan eyepiece, PL20X/12mm High eye-point wide field plan eyepiece total 2 pairs, Diopter adjustment ±5 , tube:Φ30mm
Magnification	40~2000 times (total 8 classes)
Objectives	Infinite wide field plan achromatic objective; Standard: 4X, 10X, 20X, Optional: 40X, 100X
Nosepiece	Inner 3 or 5 holes
Condenser	abbe condenser ( optional plug-in phase contrast conversion, dark field condenser interface, polarized port )
Stages	220×148mm double-layer stage X -axis steel wire mechanical moving stage, moving range: 76X50mm, precision 0.1mm, two-slice is available
Condenser Mechanical	Coaxial Coarse and Fine Adjustment, Fine Division 0.002mm
Illumination System	3WLED brightness continuously adjustable Köhler Illumination system
Digital camera imaging system	5-mega Camer, HD digital USB port, clear and smooth images, Connectable to computer to imaging and taking pictures, videos, measurement, edit, save and print.

## 2. Accessories Lists:

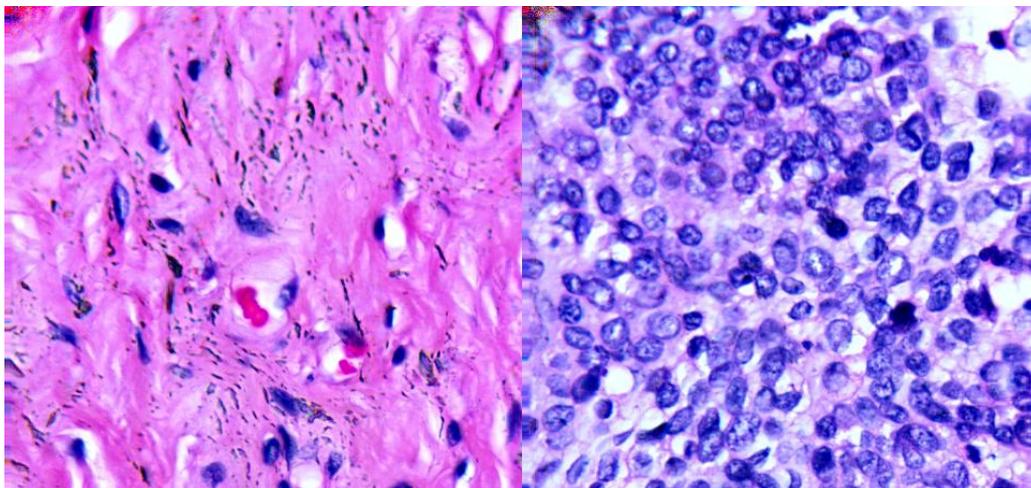
S/N	Items	Qty	Optional
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1	Hyperspectral Microscope (1000-1700nm) Host	1set	Included
2	Objectives 3 sets	1set	Included
3	Halogen lamp	4 units	Included
4	Standard Calibration Board	1 pieces	Included

## 3. Application Case

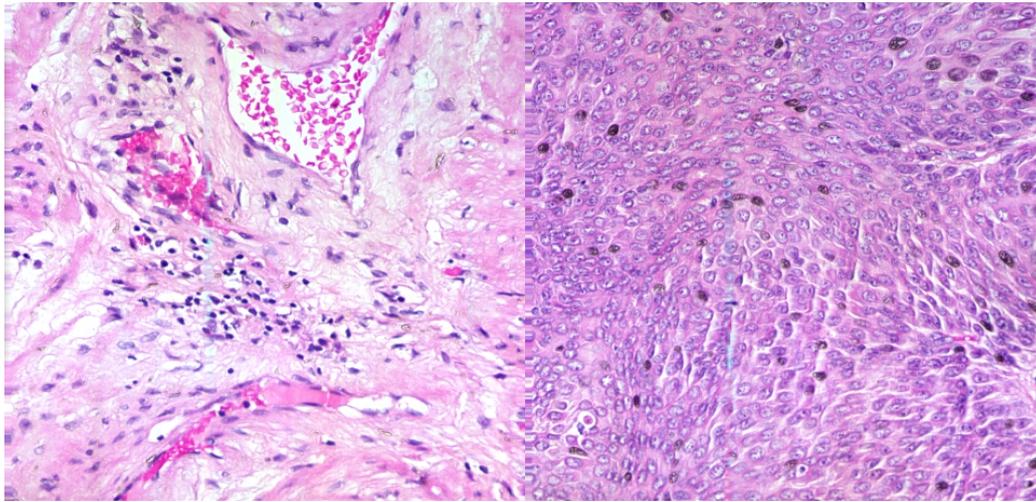
### 3.1 Tumor tissue detection

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.



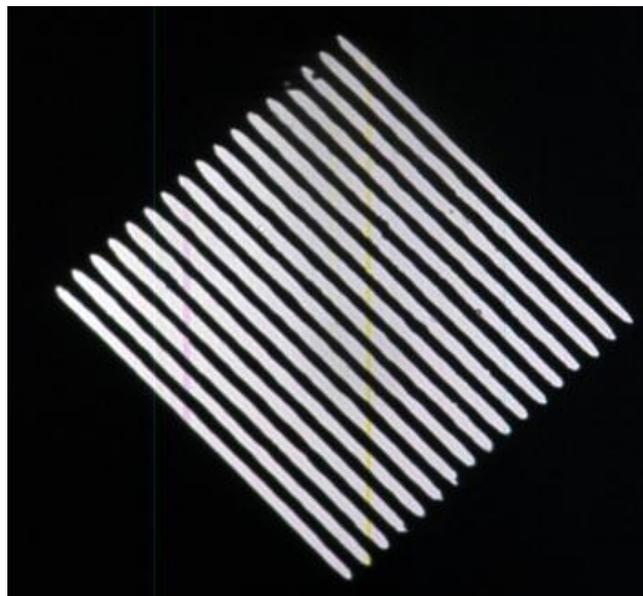
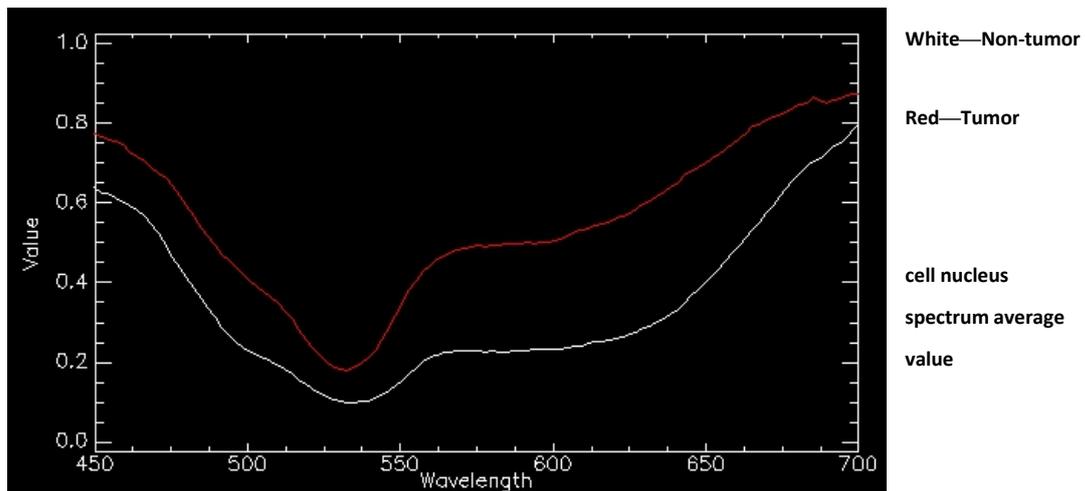
100XCervical cancer non-tumor section

100XCervical cancer tumor section

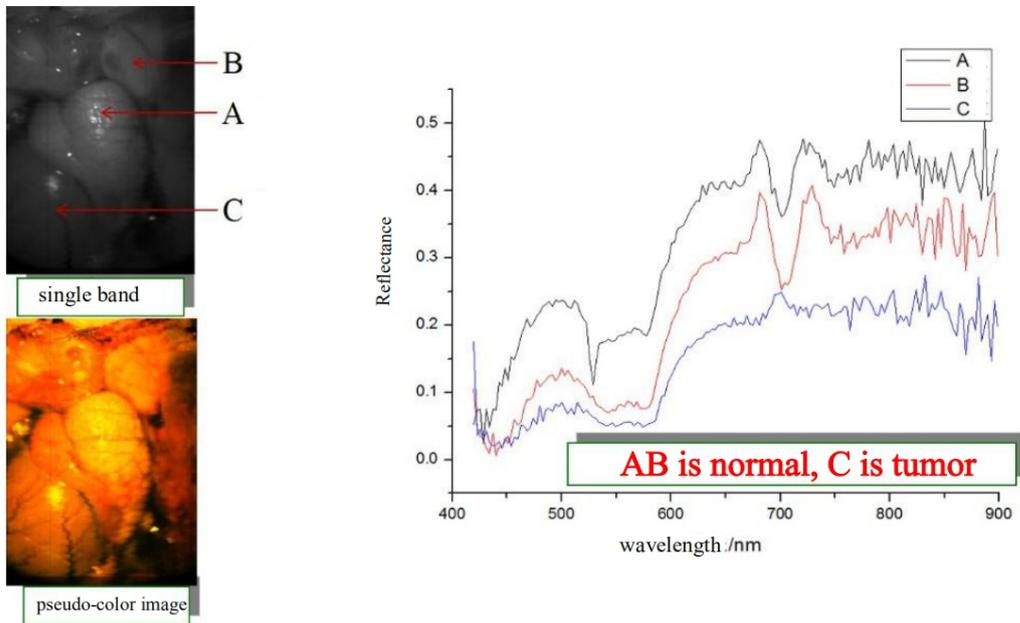


40X bladder cancer non-tumor section

40X bladder cancer tumor section



40Xresolution (2.5micron)



## 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.

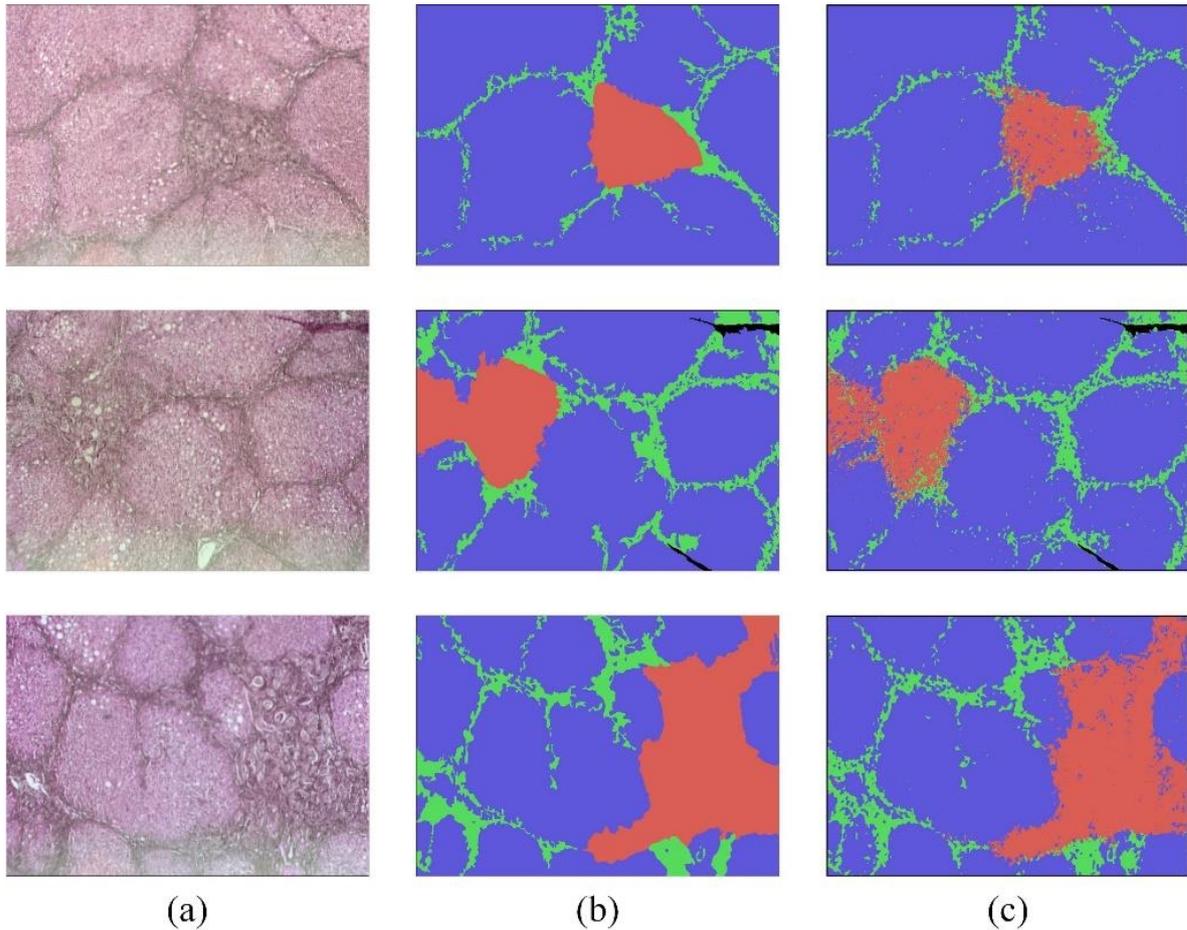


Fig 6 The results of recognition of cholangiocarcinoma tissue by Duan Yipan et al. with hyperspectral imaging microscope (a) pseudo-color composite image (b) manual annotation of the corresponding image (c) 3D-Res-CNN region of the corresponding image Recognition result

## 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 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.

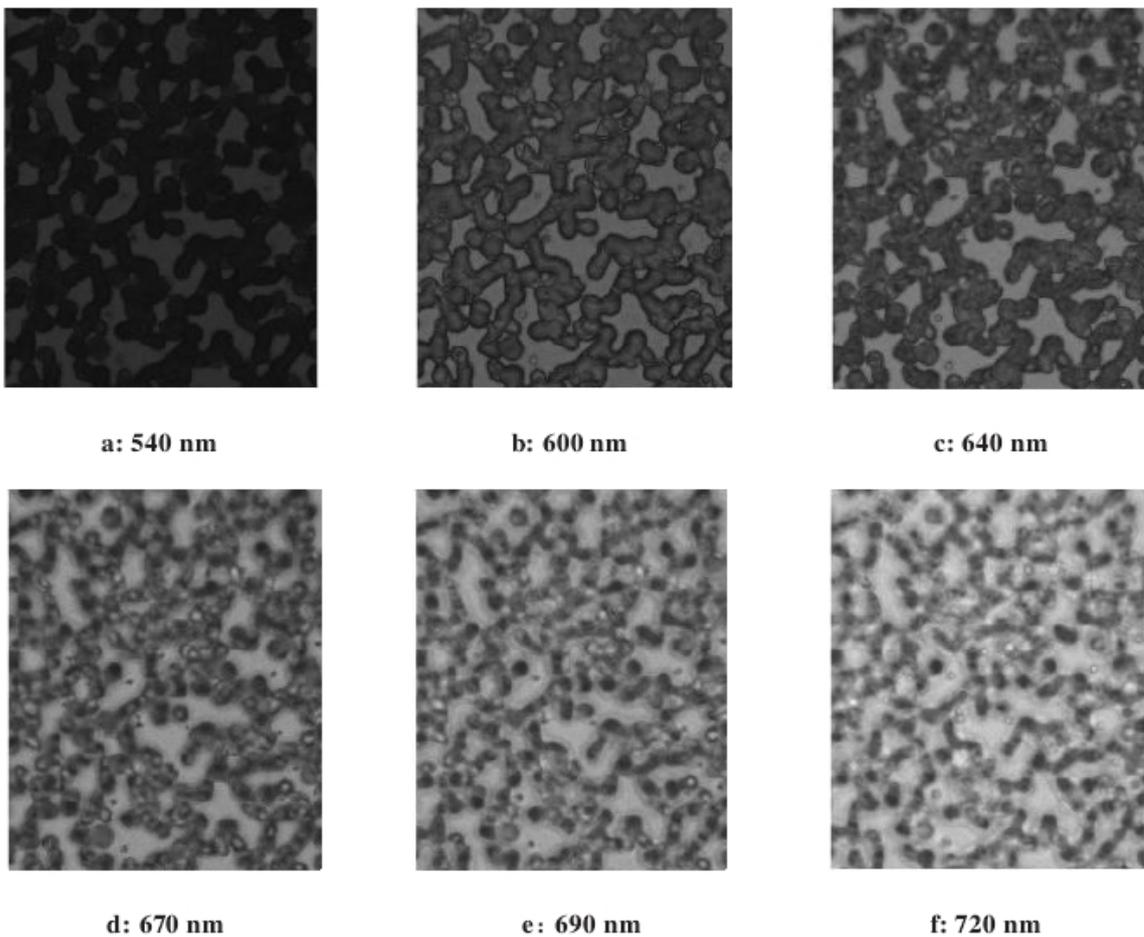


Fig 7 Hyperspectral Microscope images in different bands

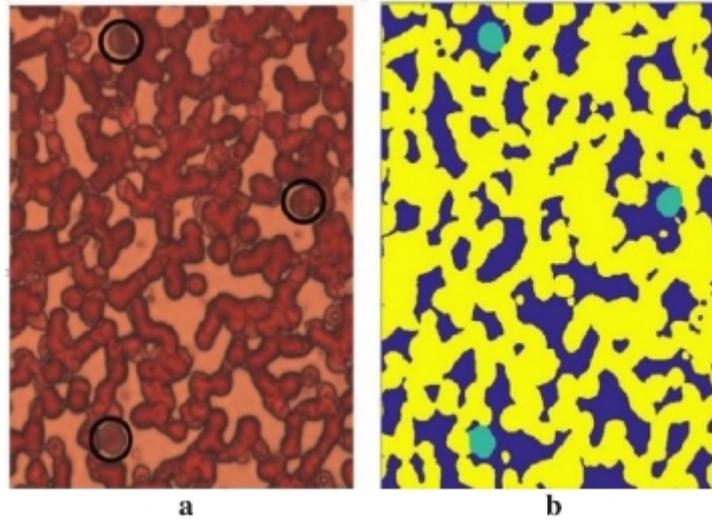
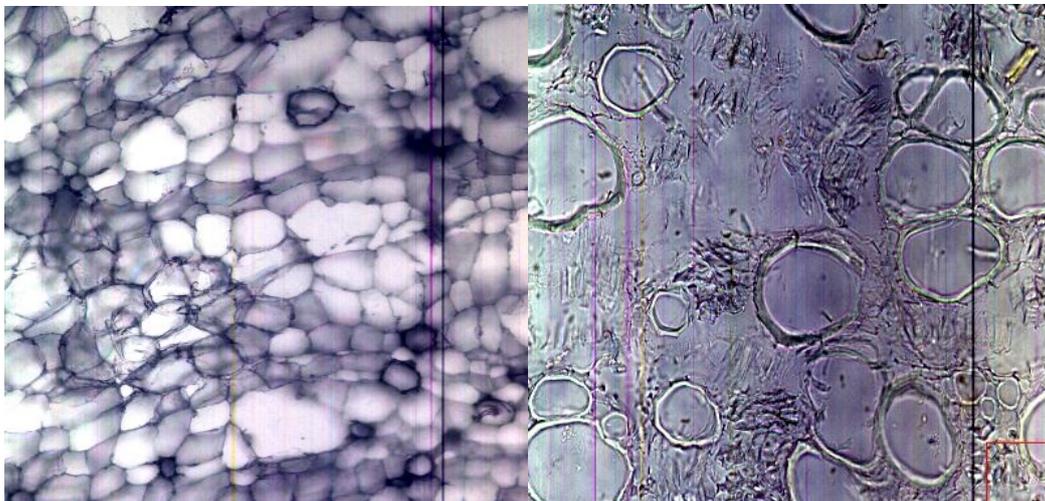


Fig 8 (a)Background, White and Red cell pseudo-color images(b) distribution

### 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%.

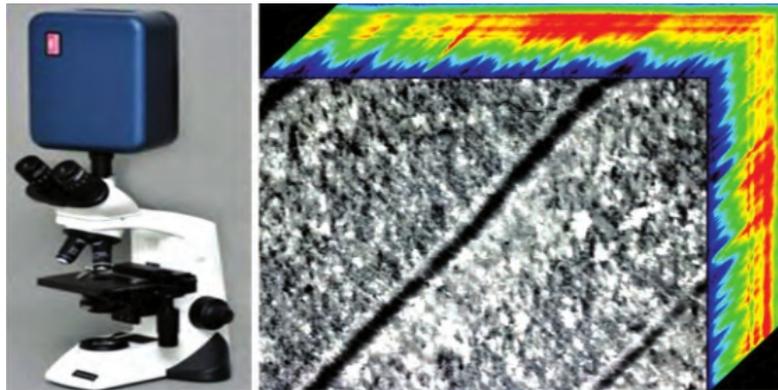


Fig 10 Hyperspectral Microscope System; ( a ): Hyperspectral Imager; ( b ): Hyperspectral cubic images database (Merbau wood in Indonesia)

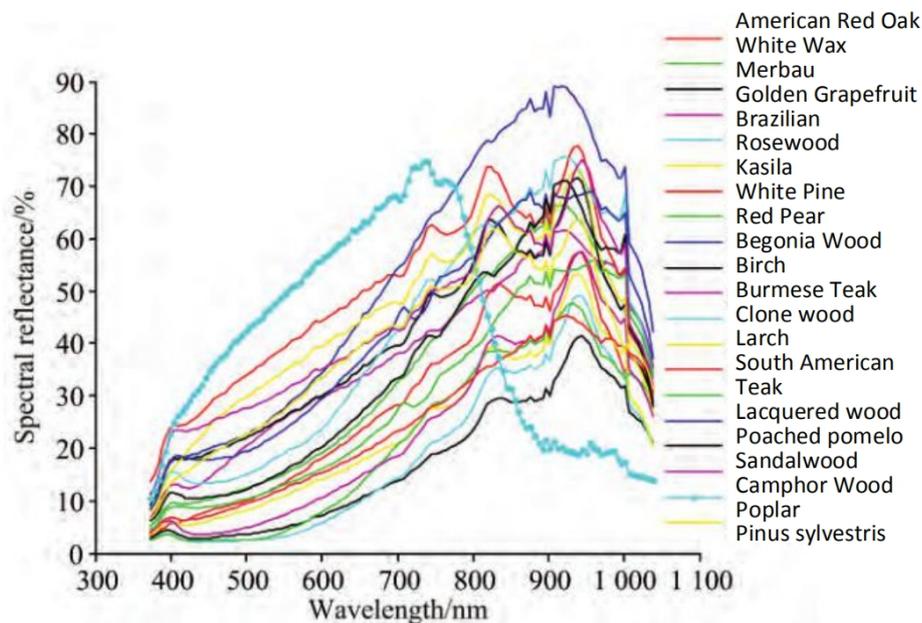


Fig 11 20 classes of woods specimen average spectral curves

## 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.

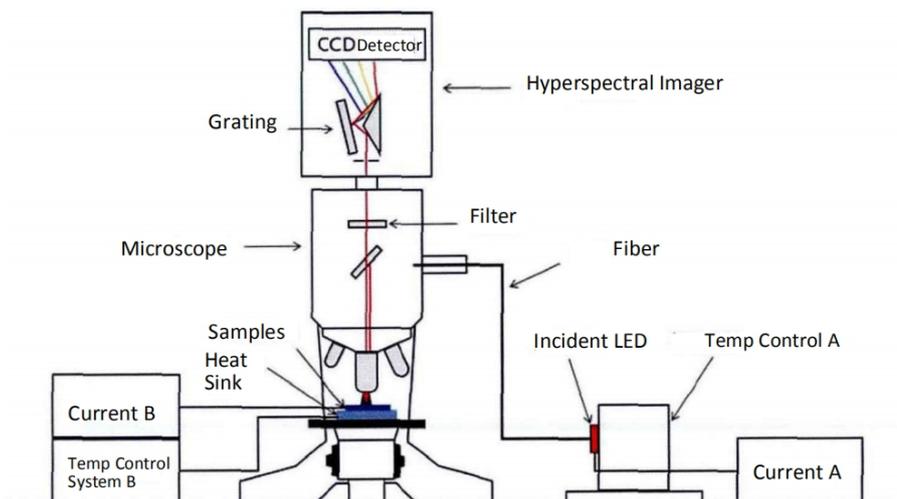


Fig 3-9 Hyperspectral Microscope Joint Temperature Lab Setup figure

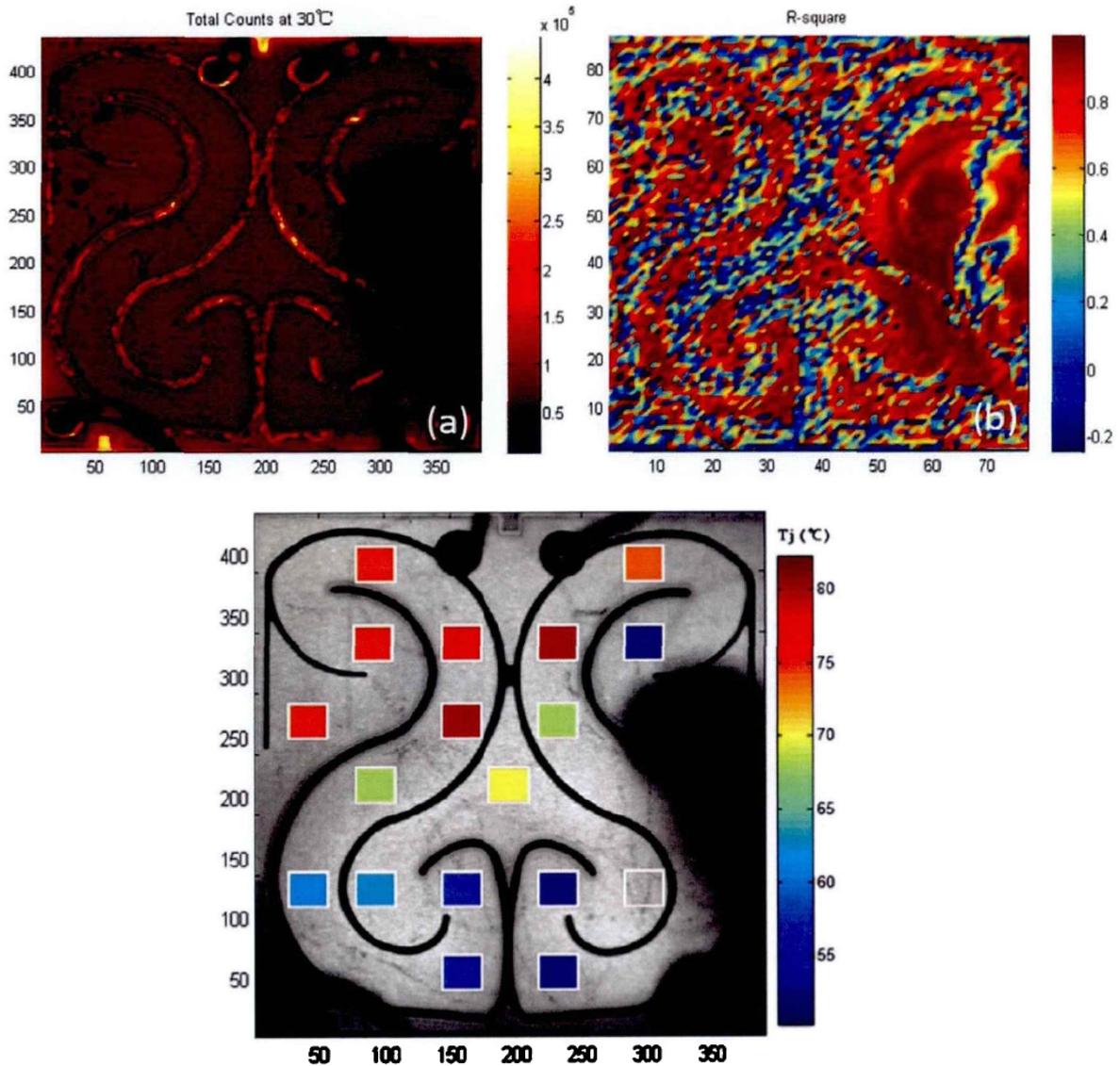


Fig 12 The Lu Yijun research group of Xiamen University measure LED 2D joint temp (500mA temperature distribution condition)  
 2.5  $\mu\text{m}$  resolution (40XObjective)

## 4. Other Hyperspectral Imaging Products:

ATH1500 Series	Feature	Application
ATH1500	400-1000nm VIS-NIR hyperspectral imaging camera	Precision agriculture, agricultural and forestry diseases and pests, vegetation analysis, planting area evaluation, crop yield evaluation, water quality analysis, artwork scanning, cultural relic identification, pattern scanning, industrial sorting, oil pollution detection, etc.

ATH1500-17	1.0-1.7 um SWIR hyperspectral imaging camera	Semiconductor, industrial sorting, food sorting, construction waste sorting, meat sorting, plastic sorting, geological prospecting, mineral exploration, cultural relic identification, judicial identification, document inspection.
ATH1500-25	1.2-2,5 um SWIR hyperspectral imaging camera	Precision agriculture and food analysis, dark plastic sorting, geological prospecting, mineral exploration, national defense and military industry, cultural relic identification, judicial identification, document inspection, moisture content analysis, medicine and material sorting, mineral mapping, medical identification, waste recycling.
ATH1500-50	2.5-5.0 um MWIR hyperspectral imaging camera	Geological survey, national defense and military industry, gas analysis, VOCs inspection, water temperature detection, land cover type identification, camouflage investigation, mineral sorting.
ATH1500-12-50	1.2-5.0 um SWIR hyperspectral imaging camera	Geological survey, national defense and military industry, gas analysis, VOCs inspection, water temperature detection, land cover type identification, camouflage investigation, mineral sorting.
ATH1500-04-17	0.4-1.7 um VIS-NIR hyperspectral imaging camera	Precision agriculture, agricultural and forestry pests and diseases, vegetation analysis, planting area evaluation, crop yield evaluation, water quality analysis, artwork scanning, cultural relic identification, pattern scanning, industrial sorting, oil pollution detection, etc.



Fig 13 Left: ATH1500 VIS-NIR hyperspectral imaging camera; right: ATH1500-17 SWIR hyperspectral imaging camera



Fig 14 ATH9010/11/12 Airborne hyperspectral remote sensing system

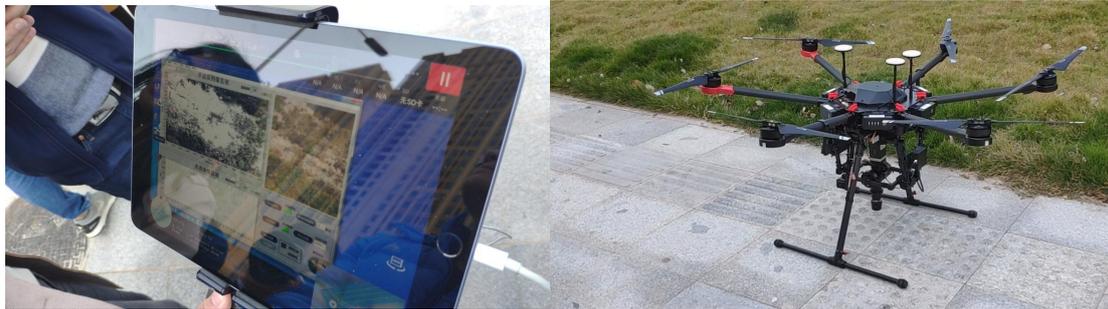


Fig 15 Ground flight control system and airborne hyperspectral remote sensing system



Fig 16 Airborne hyperspectral remote sensing system flying experiment.

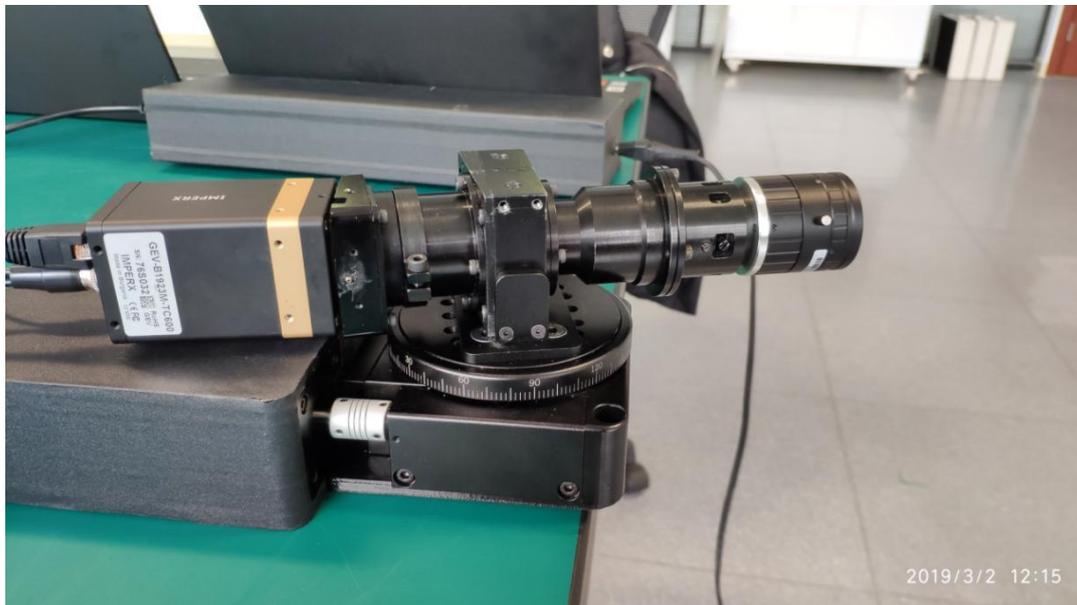


Fig 17 ATH1010 hyperspectral camera



Fif 18 ATH8010 Lab hyperspectral imaging system

## 5. Company Profile

Optosky company is an first-class spectroscopy solution provider, with the headquarter locates in the 7<sup>th</sup> floor of the research institute of the Chinese Academic of Science at an area of 2500 square meter in Xiamen city where successfully held the international 9<sup>th</sup> BRICK summit in 2017. The subsidiary company locates in Wuhu city with an area of 2035 square meter.

The company founder Dr. Hongfei, Liu graduated Doctor degree from Chinese Academic of Science and postdoctoral degree from Xiamen University, by integrating both of top Universities' spectroscopy technology background into Optosky company aiming at developing the leading spectroscopy equipment in the world.

The company bases on unique technologies of Optomechatronics, Spectroscopy Analysis, Process Weak Optical and Electrical Signals, Cloud Computing, and have been developed wide products line of the competitive Raman spectroscopy instruments, micro spectrometer, hyperspectral imager, field spectroradiometer, fluorescence spectroscopy, LIBS etc. Driven by advanced technologies and products, Optosky brand has been well-known to customers all over the world.

Optosky company base on technologies innovation, market driven direction, customer first, provides first-class products and services, and one-stop solutions to many fortune 500 companies in many industries. The company received praise from different industries companies, as well as many innovative intellectual property, software copyright, qualification certification, and winner awards over hundred numbers.

Optosky receives top class A introduced high-tech company to international Xiamen city, the national high-tech and new innovative technology company award. The founder Dr.Hongfei Liu receives the innovation talent award by ministry of science and technology.

The company is currently conducting the exclusive project of major industrialization national oceanic administration with a total fund of five million us dollar. The company in charge of drafting national industry standard of VNIR and SWNIR Field Spectroradiometer, and six national standard drafter, including China National Standard Drafter for Hazmat detector based on Raman spectroscopy, China National Standard Drafter for Buoy-type Monitor eco-environment, China National Standard Drafter for water quality monitor in unmanned boat, China National Standards drafter for online water quality monitor by spectroscopy, China National Standard Drafter for UV-absorbent measure fabrics.

The company has over 70 IPs and over 20 innovative patents.

The company received ISO9001:2015 certification, CE certification, Police Administration Certification, FDA approval compliant, IQOQPQ compliant.



Figure 1 Optosky (Xiamen) Photonics Inc. Company Headquarter

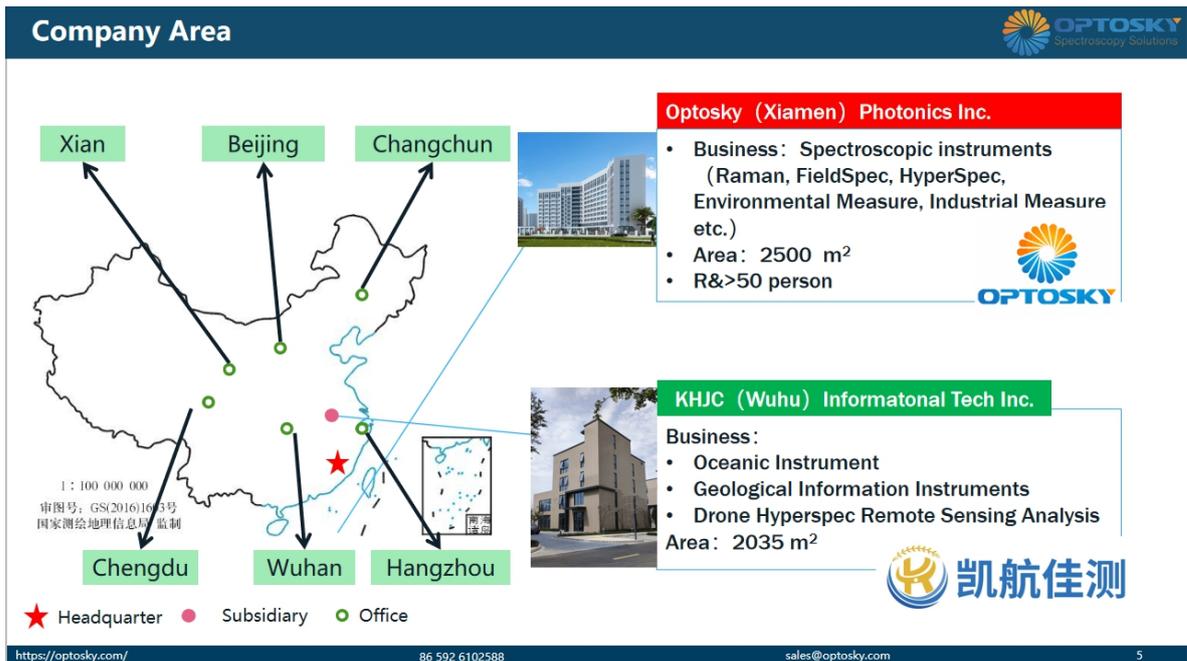


Figure 2 Optosky Company Area

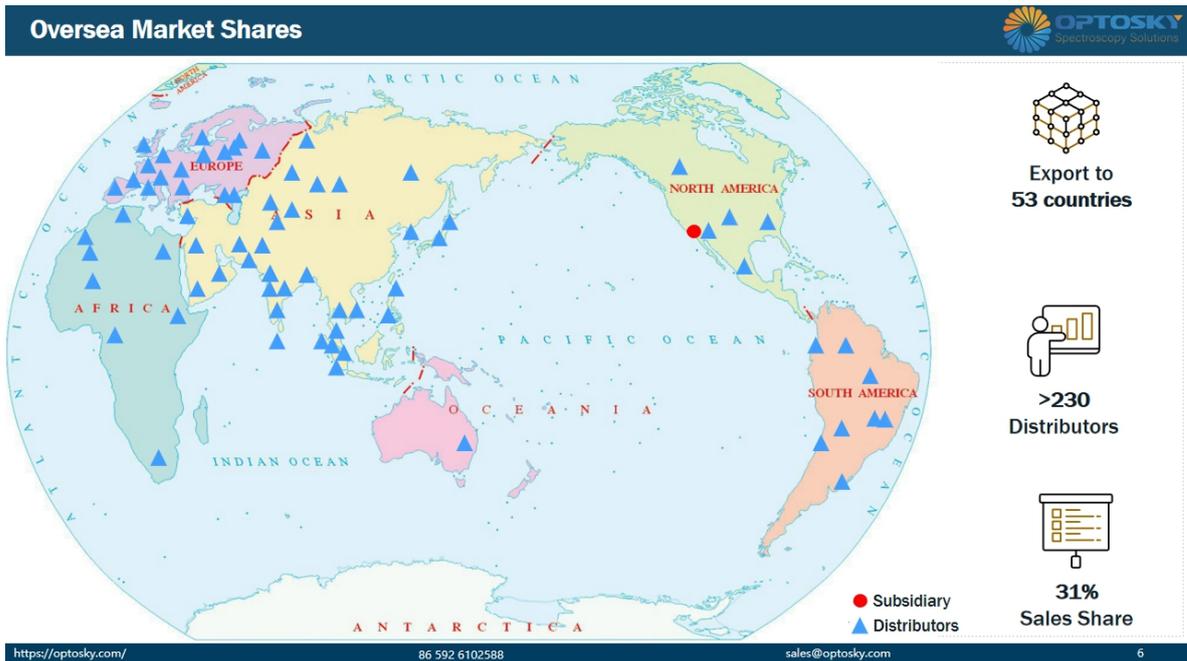


Figure 3 Oversea Market Shares



Figure 4 Optosky Chair and Draft National Standards Lists.

Qualification



 <b>ISO9001:2005</b>	 <b>GB/T 23001</b> Informationization & Innovation	 <b>CE, RoHS, LVD</b> 17 models	 <b>Police Approval</b> 11 models
 <b>GB/T 29490</b> IP implementation	 <b>5 Innovative patents</b>	 <b>35 patents</b> new utility design	 <b>32 Software copyright</b>

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Figure 5 Qualification

## Informationization & Industrilization Fusion Management System

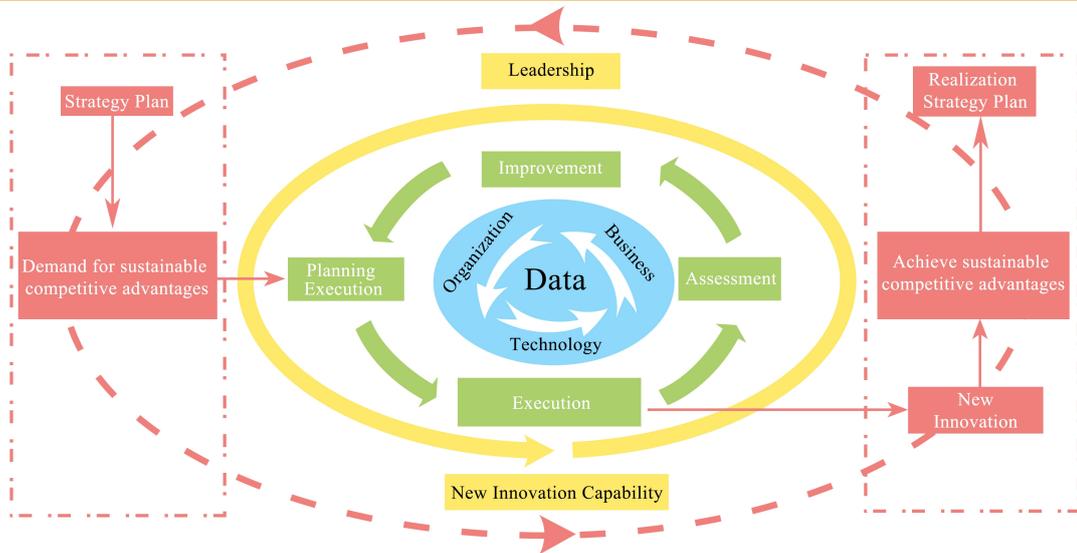


Figure 6 GB/T 23001\_ Informationization & Industrilization Fusion Management System

**Co-Founder—Dr. Hongfei Liu**



**Honors**

- Selected by science & technology ministry as "Innovation Talent"
- CCTV Science & Technology Interview
- Top Class A Talent credited by Xiamen City
- Innovation Hero**

**Education**

- PhD • Chinese Science of Academic • Prof. Gui-Lin Chen, Originator in spectroscopy
- Postdoctoral • Xiamen University • Prof. Zhong-Qun Tian guided by the SERS founder M.Fleischmann

**Career**

- Engineer → R&D Manager → GM
- Agilent**, Leader of instrument, Fortune 500 company, Job: engineer
- II- VI Incorporated (Nasdaq: IIVI) leader in optical & electrical industries, Job: GM of Instrumentation and Automation

**Academic**

- University graduate tutor
- obtain more than 60 IPs, more than 10 Innovation patents;
- Publish more than 20 papers, 2 recorded SCI, 8 recorded EI



Selected "Innovative Talent" by Science and Technology ministry



Top Class A Talent by Xiamen City



Founder & Tutors

**Postdoctoral Hongfei Liu**

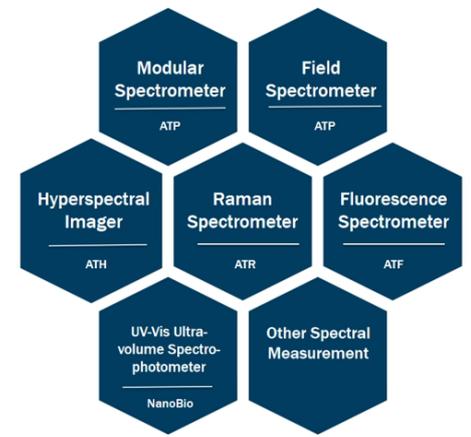
- Selected "Innovative Talent" by Science and Technology ministry
- Top Class A Talent by Xiamen City
- CCTV Science & Technology Interview
- Fortune 500 experience in Agilent, II-VI

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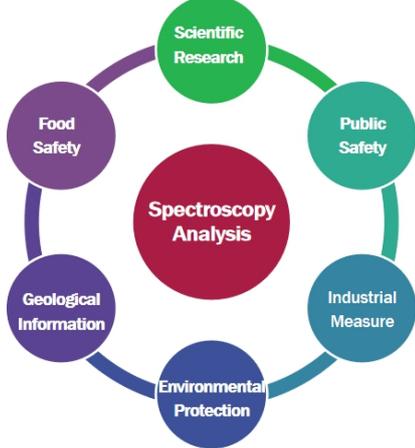
Figure 7 Optosky's Co-founder\_Dr. Hongfei Liu

**Category & Application**

**Category**



**Application**



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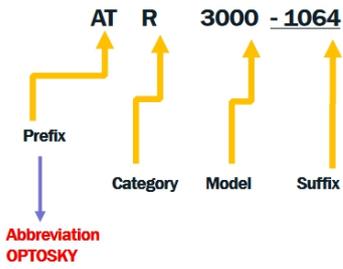
Figure 8 Category & Application



## Model Name Rule

**Model Name Rule:**

- Prefix
- Category
- Model
- Suffix



- **ATR** - Raman Spectrometer
- **ATP** - Micro Spectrometer
- **ATH** - Hyperspectral Imager
- **ATF** - Micro Fluorescence Spectrometer
- **ATL** - LIBS
- **ATW** - Water
- **ATE** - Environment Protect
- **ATFD** - Food Safety
- **GA** - Public Safety (**Gong An**)
- **GF** - Gas Monitor (**Gas Finder**)
- **GY** - Industrial Monitor (**Gong Ye**)

eg:

- Raman Microscope: ATR8300MP-1064
- Hyperspectral Imager: ATH9500

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Figure 9 Model Name Rule