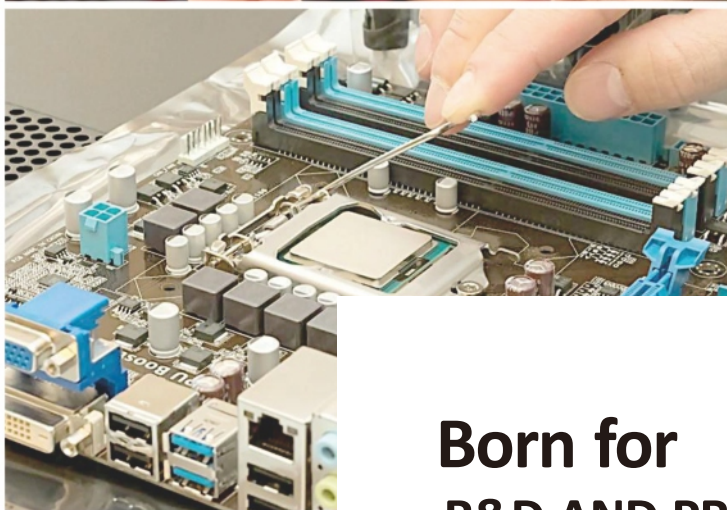
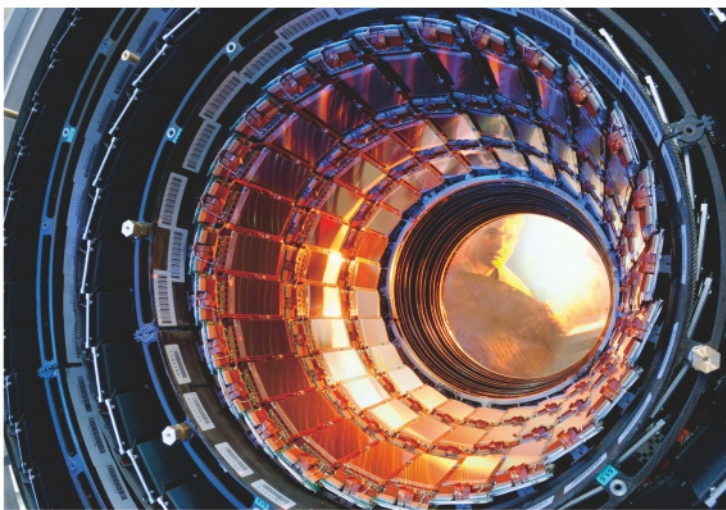
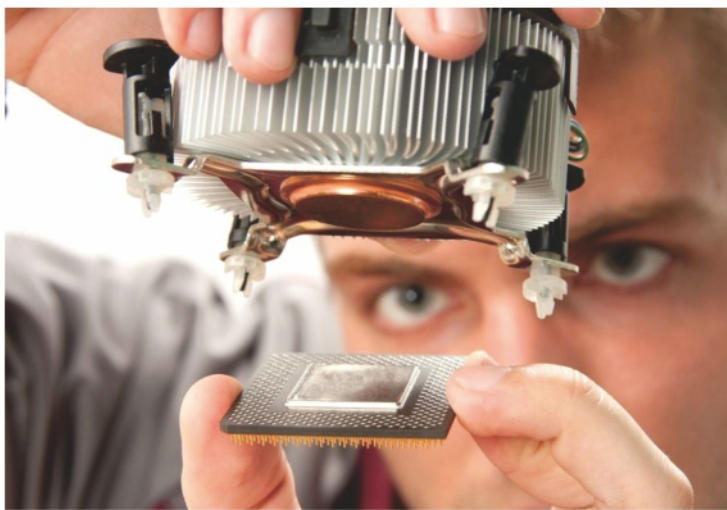


FOTRIC



Hand-Held More Convenient | Longer Time Online
More Professional Analysis | Faster Sharing

FOTRIC 220



Born for
R&D AND PROFESSIONALS
FOTRIC 220 Series Thermal Camera



R&D user's measurement scene is complex and varied, including not only temporary detection tasks, but also lots of continuous sampling tests (such as trend analysis, reliability test, destructive testing, etc.), and continuous sampling tests may reveal more valuable data.

R&D users often face a dilemma when choosing a thermal camera: They may select a handheld thermal camera but cannot perform continuous sampling tests or they may select an online thermal camera, but lack flexibility.

The FOTRIC 220 series thermal camera makes the selection no longer difficult. It's not just a handheld thermal camera, but also an online thermal camera. It is more competent in long-term data sampling tests.



FOTRIC 225
Resolution: 320×240



FOTRIC 226
Resolution: 384×288



FOTRIC 227
Resolution: 512×384



FOTRIC 228
Resolution: 640×480

FOTRIC 220

Hand-Held Is More Convenient

Smartphone Full Touchscreen Operation

Easy-to-learn smartphone touchscreen APP user interface, ultra-simple operation, and ready to use.

Fully-Radiometric Short Thermal VideoStream To Capture More Details

A smartphone connected with a FOTRIC thermal camera can record directly up to 1,000 frames of fully radiometric video and capture temperature change processes in real-time with a user-defined sampling rate (up to 5 frames per second). It can automatically collect data without a PC.

Analyze The Thermal Image And Video Conveniently On The Smartphone

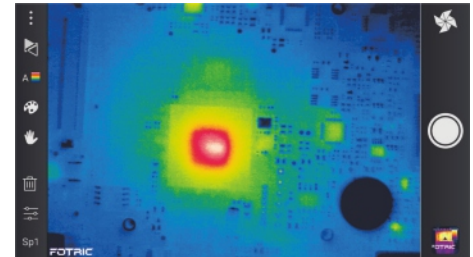
The FOTRIC 220 series supports the instant analysis of the thermal image and thermal video on the smartphone, which is convenient after the thermal image or thermal video is recorded.

Flexible Sub-regional Emissivity Setting And Professional Temperature Measurement Parameter Correction

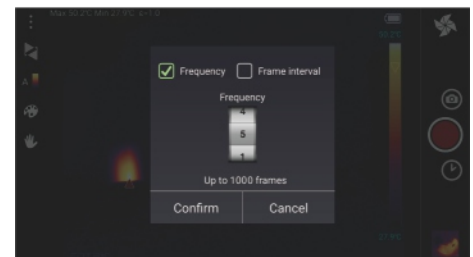
The different emissivity of each sub-region can be set to achieve an accurate temperature measurement of different material. At the same time, transmissivity, test distance, etc. can be set to ensure the accuracy of the temperature.

Long Battery Life And No Worry Of Frequent Charging

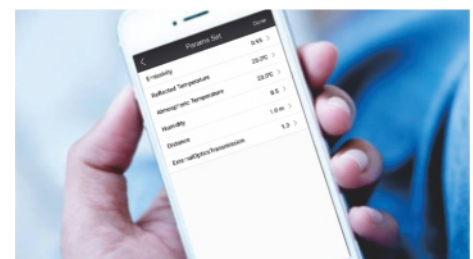
The low-power design gives FOTRIC thermal camera more than 10 hours of battery life, to ensure a full day without interruption, allowing users to focus on work.



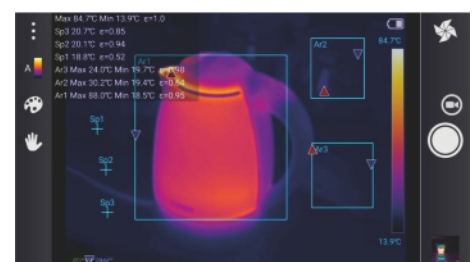
Full Touchscreen APP User Interface



Customize Sampling Rate



Instant Analysis Of Thermal Image On The Smartphone



ROI Emissivity And Parameter Setting On The Smartphone



10 Hours Battery Life Of The Thermal Camera

Associate Thermal Image With Detected Object Automatically For Easy And Efficient Data Management

FOTRIC thermal camera can scan the equipment QR code and automatically tag thermal images, thus avoiding cumbersome, inefficient and erroneous manual entry.

Instantly Share Thermal Images/Videos Through Favorite Channels

Rapidly share field data with colleagues and solve field problems with remote diagnosis through your favorite channels such as Message, Facebook, LinkedIn, Twitter, etc.



Longer-Time Online

High-Quality Product With Longer Time Online

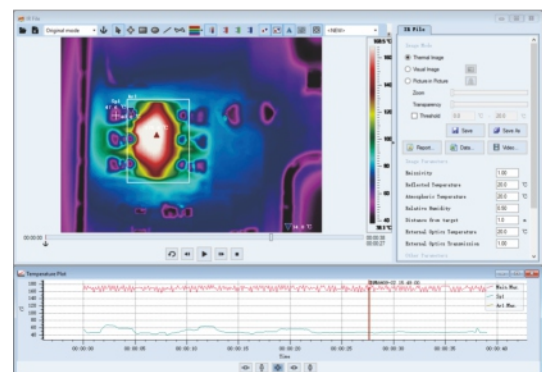
FOTRIC 220 series thermal cameras use expensive, high-end, and long-term work electronic components to ensure long-time normal operation and maintain long service life. With the bypass power supply design, FOTRIC thermal camera can work long-term without interruption under the external power mode.



High-end Electronic Component + Professional R&D Test Platform
For Longer-time Online

Fully Radiometric Thermal Video Stream

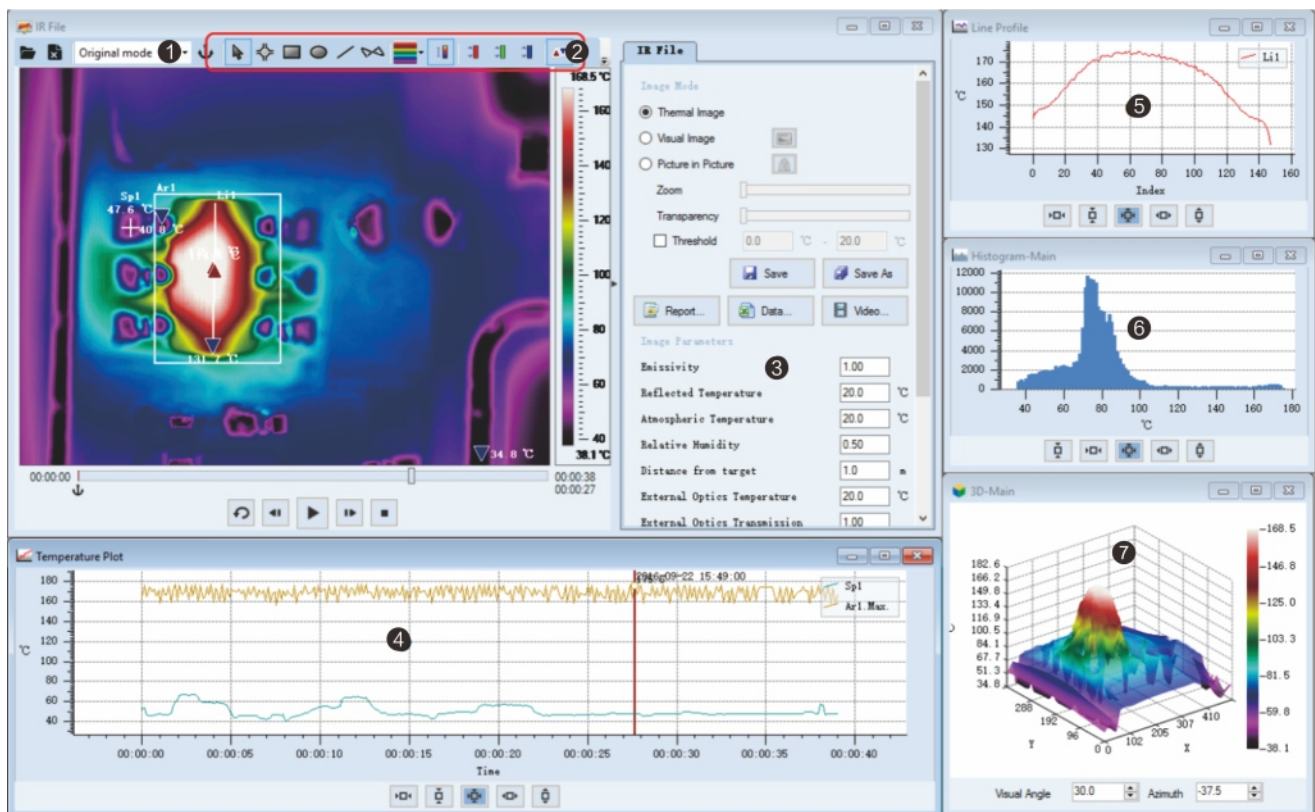
FOTRIC 220 series thermal camera works with professional PC software, AnalyzIR, to record fully radiometric thermal video. Each frame of the video stream preserves the original temperature of each pixel.



Any Temperature Spot Or Region Can Be Added And A Temperature Vs.
Time Curve Can Be Plotted

AnalyzIR – Professional Analyses Software

FOTRIC AnalyzIR software is developed to meet the needs of R&D users, from the image, temperature and time of the three-dimensional perspective to analyze the test data. One thermal picture will have more details and process of changes than the conventional equipment maintenance class thermal imager to obtain more in-depth research, more reliable data, and more valuable paper.



Note:

1. Original / temperature difference mode
2. Spot, line, box, palette, isotherm and other tools
3. Pre- and post- sampling temperature correction; support sub-regional emissivity setting
4. ROI temperature vs. time curve; ROI+ROI temperature vs. time curve; Overlay comparison of different thermal video curve
5. Plot of temperature along the line
6. Histogram
7. 3-D thermal image

1TB Oversized File, Recording Thermal Data Without Interruption

Thermal data collected under the long-term online mode is very large. FOTRIC 220 series companion software, AnalyzIR, supports up to 1TB single fully radiometric thermal video recording, which helps R&D users to record the complete data for the entire experimental process.

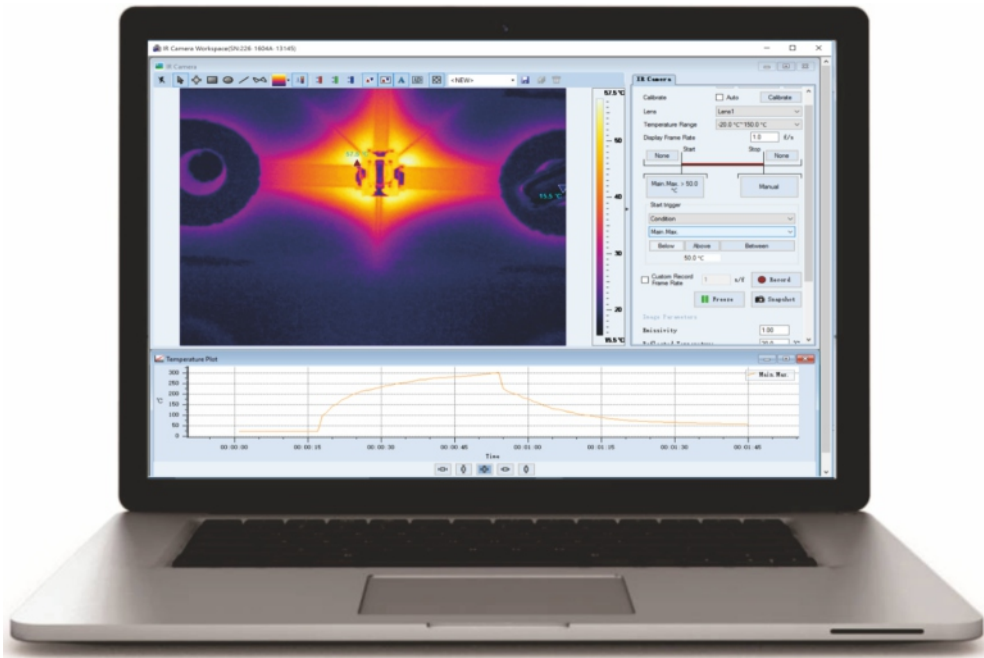
FOTRIC Model	Fotric 225*	Fotric 226	Fotric 227*	Fotric 228
1TB single file recording time (Calculate at 1HZ frame rate)	~50 days	~40 days	~20 days	~15 days

(*) Available on the upgraded model

Automatically Collect Data And Free Up Human Resources

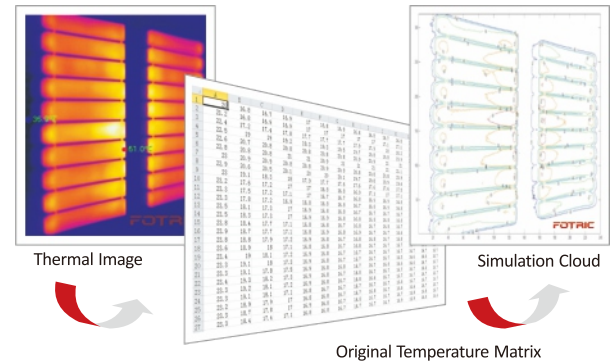
Three kinds of automatic data acquisition modes:

- ① Time trigger ② Temperature trigger ③ External I/O trigger



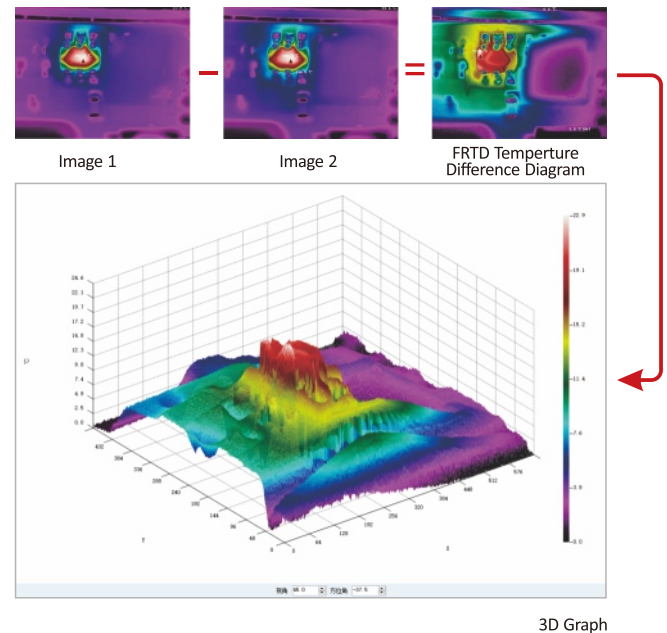
Raw Temperature Data Matrix

Users can pick up any frame of thermal image, save as a fully radiometric thermal image, and export to the .CVS file containing the original temperature of all pixels. These raw temperature data will help you optimize the algorithm, or use other software to generate a simulation contour map.



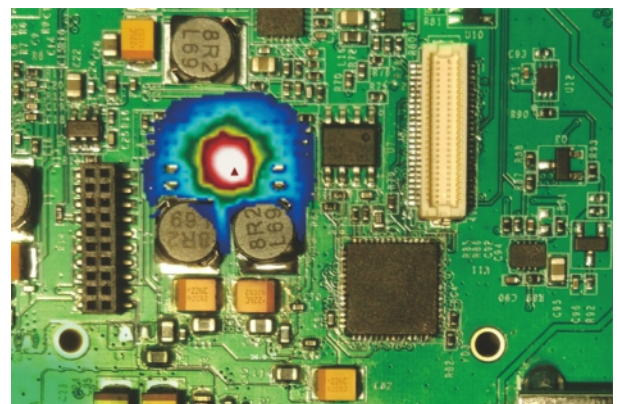
Full Range Of Temperature Difference FRTD Analysis To Reveal Tiny Differences Clearly

Obtain the temperature difference of any two thermal pictures intuitively for faster and more accurate analysis, and generate a more understandable report.



Picture-In-Picture And Picture Fusion Function

Support picture-in-picture (PIP) and picture fusion function; inspect the temperature of a specific area

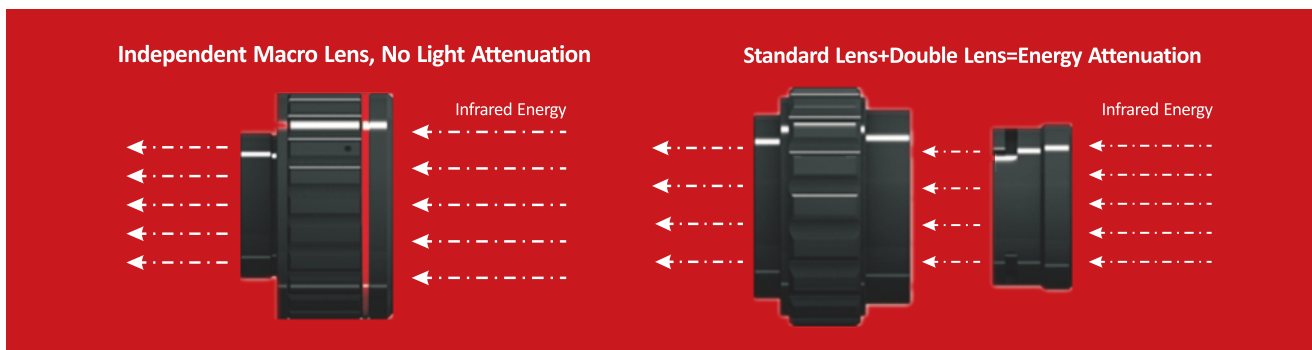


Support Picture-In-Picture And Picture Fusion Function

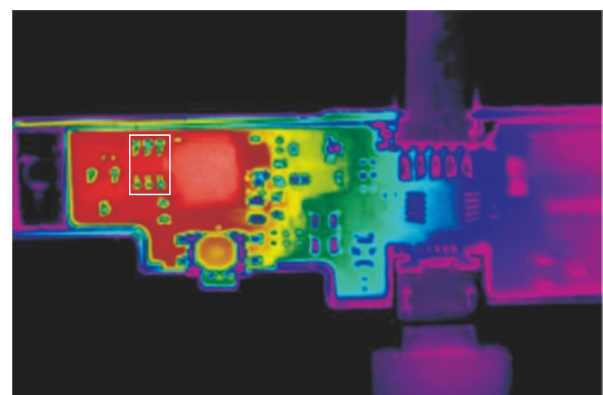
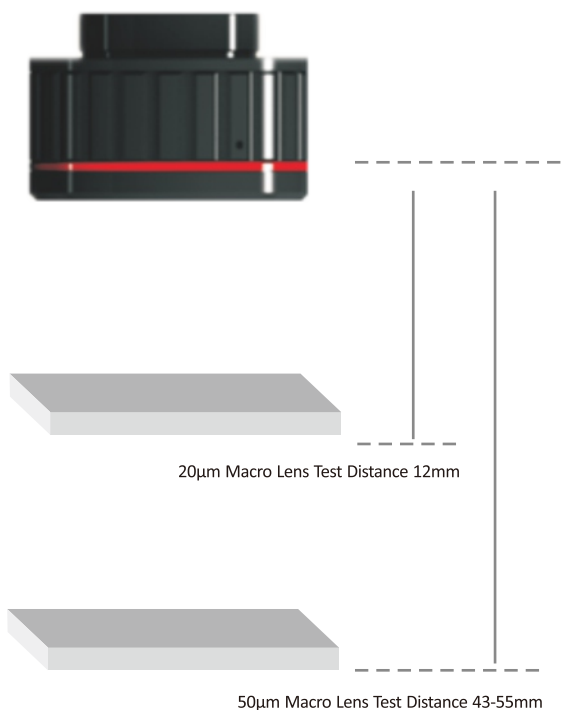
R&D Macro Lens = Independent Lens + Independent Calibration

FOTRIC 220 Series Thermal Camera Is Capable of 20μm Micro Temperature Distribution Measurement.

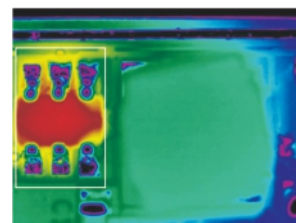
- **Independent Macro Lens:** No energy attenuation to ensure thermal image quality; while standard lens plus magnification lens increase optical attenuation, reducing the image quality.
- **Independent Lens Calibration:** FOTRIC's original macro lens is temperature-calibrated in a one-on-one with the host thermal camera; temperature accuracy is guaranteed. 50μm Macro Lens test distance 43~55mm The size of the chip in the white box 3 is about 3mmx1.5mm.



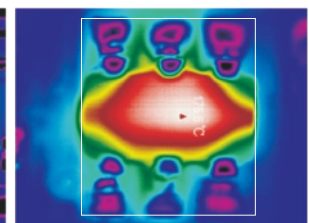
Macro Lens Illustration



Standard Lens 15cm Test Distance (in White Area, The Chip Size 3mmx1.5mm)

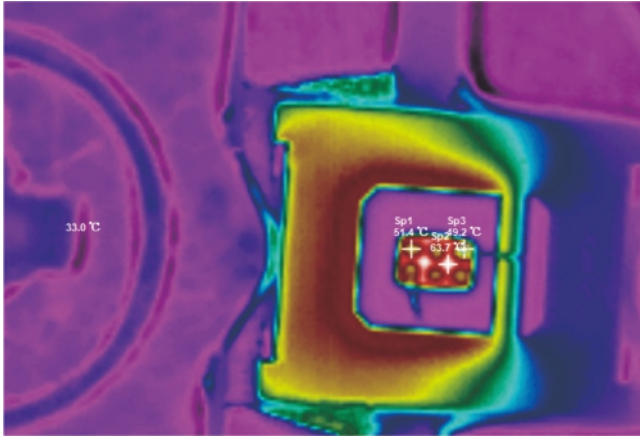


50μm Macro Lens



20μm Macro Lens

Typical Applications

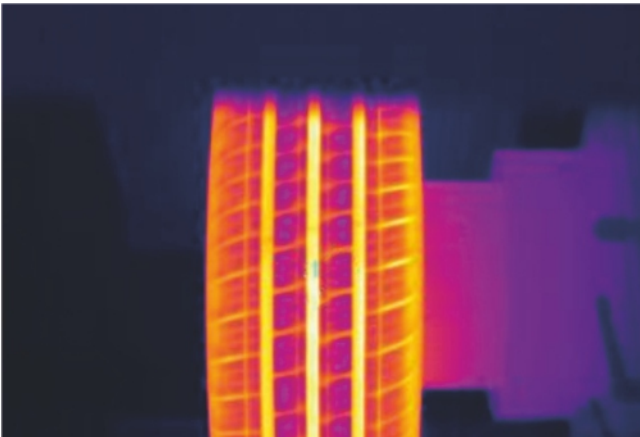


Electronics Industry

Unpacked Chip Internal Temperature Distribution Inspection

Test Difficulty: Single thermal image is not enough for most electronic thermal distribution analysis. It needs to capture the temperature change process and the entire experiment temperature changes, especially for devices as small as a chip.

Solution: For the test of small targets such as chips FOTRIC 226 thermal imager with 50μm macro lens can be used, or FOTRIC 227/228 thermal camera with 20μm macro lens. Through the FOTRIC 220 series software online model and AnalyzIR online analysis function, user can continuously detect the temperature changes and the recordings can also be analyzed later.

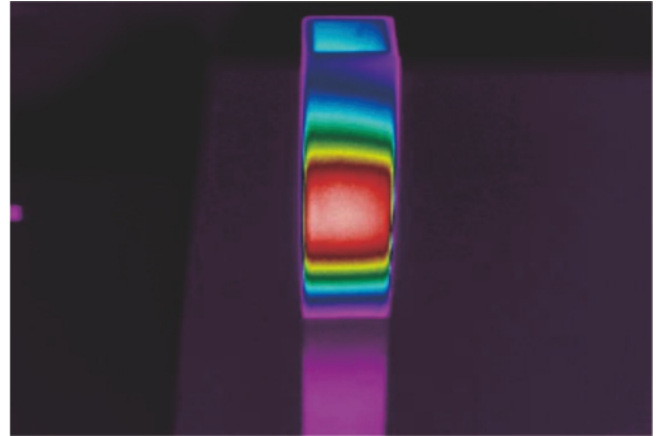


Automobile industry

Fatigue Life Test Of Tire

Test Difficulty: Tire durability test requires a long time monitoring, generally up to 7-10 days, and needs to record the entire process. Impact test requires a higher sampling frame rate.

Solution: FOTRIC 220 series thermal camera has bypass power supply design. It can use external power supply and won't lead to battery heating. The online analysis feature can be connected to PC software to record and analyze the data. User can customize the frame rate for impact test such as 30Hz high frame rate recording, and lower the frame rate in the durability test to reduce the amount of data. FOTRIC 220 series thermal imager supports 1TB single thermal video stream recording, suitable for the recording of long-term online test.

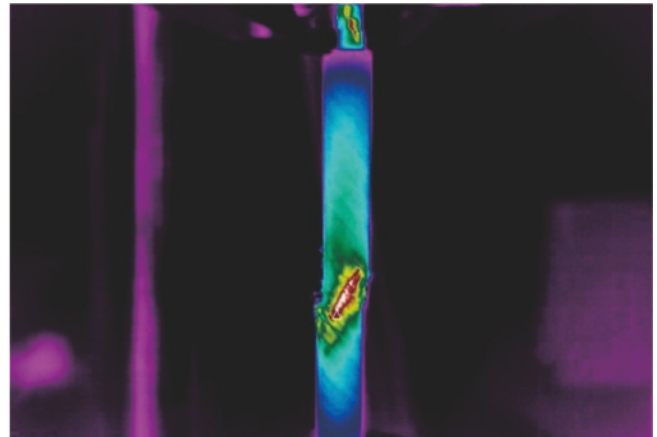


Biomedicine

Targeting Nanomaterials

Test Difficulty: Record the entire experimental process and compare the temperature changes of different test samples

Solution: FOTRIC 226 thermal camera with B3s universal test bench can be used to observe the temperature changes horizontally in material testing and laterally in vivo experiment. Online analysis function can record the entire experimental process in real-time, and use the superposition of the time-temperature curves for direct comparison of temperature changes between different test samples.



Test Of Material Characteristic

Carbon Fiber Fatigue Test

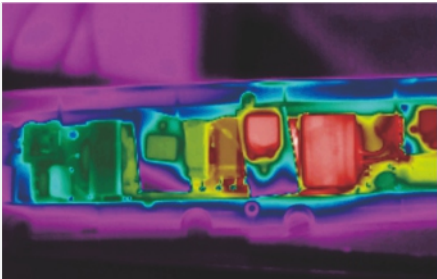
Test Difficulty: Capture the moment of fracture and record the temperature changes for post-test analysis

Solution: Rupture moment is a sudden occurrence behavior which can be captured through the long-term online detection. FOTRIC 228 thermal imager with B3s universal test bench can free up the labor and achieve the online monitoring. Through the on-line analysis feature and recording function of AnalyzIR to record the entire temperature process, the trend analysis of temperature vs. time can intuitively show the temperature changes. And the temperature difference model is easy to analyze the temperature rise.

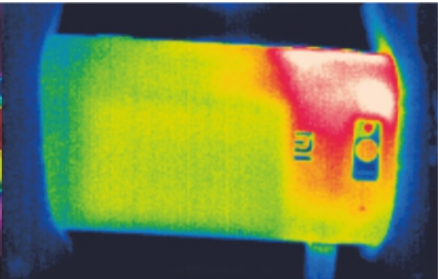
Other Applications



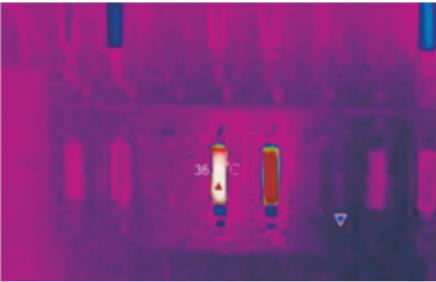
Heat Dissipation Study



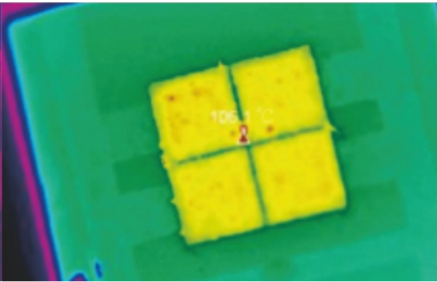
Comparative analysis of heat dissipation effect of different copper/aluminum material



Skin comfort test for electronic product network license



New energy battery



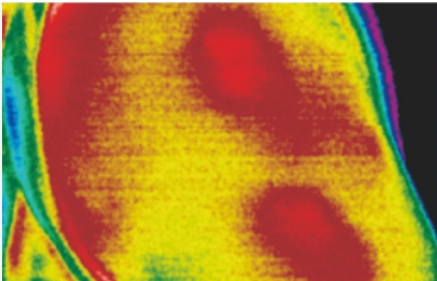
LED chip local hot spot



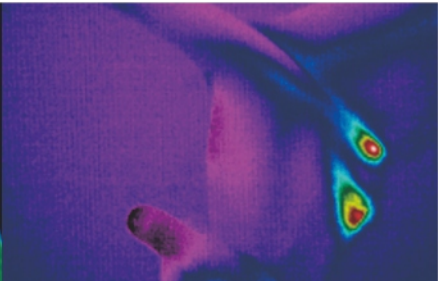
New Energy And Energy Saving



Biological Test



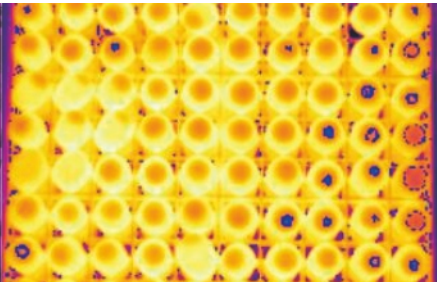
Inspection of muscle fatigue chronic stiff



Help Yangtze River finless porpoise protection



Distribution Cabinet Detection



Egg hatching status monitoring







Other Studies

Specifications

	FOTRIC 225	FOTRIC 226	FOTRIC 227	FOTRIC 228
Infrared Imaging				
IR Resolution	320 × 240 pixels	384 × 288 pixels	512 × 384 pixels	640 × 480 pixels
Field of View (FOV)	24°× 18°	28°× 21°	23°× 17°	28.7°× 21.6°
Temperature Range	-20℃ ~ +650℃ (-4°F ~ +1202°F)			
Minimum Focus Length	0.15m (Standard Lens)		0.1m (Standard Lens)	
Spatial Resolution (IFOV)	1.27mrad		0.78mrad	
Thermal Sensitivity (NETD)	≤0.06℃@30℃		≤0.05℃@30℃	
Measurement Accuracy	± 2℃ or ±2% whichever is greater @ Environment Temperature 10℃~35℃			
Focus	Manual			
Spectral Range	8~14μm			
Detector Type	Focal Plane Array (FPA) uncooled microbolometer			
Zoom	8X continuous digital zoom		10X continuous digital zoom	
Image Processing				
Palettes	15 palette options (Gray White, Gray Red, Iron Red, Rainbow, etc.)			
Palette Switching	Tap palette icon			
Noise Calibration	Automatic noise calibration FFC / Manual noise calibration FFC			
Measurement And Analysis				
Correction Settings	Emissivity, reflected background temperature, relative humidity, ambient temperature, measuring distance, transmission			
Emissivity Adjustment	0.1~1.0			
Regional Emissivity Adjustment	Support			
Automatic Capture of High, Low and Average Temperature	Support			
Isotherm	Above / Below			
ROI Measurement Modes	8 moveable spots 8 moveable area boxes (min/max) 1 line (min/max) Emissivity set for each ROI		12 moveable spots 12 moveable area boxes (min/max) 3 lines (min/max) Emissivity set for each ROI	
Temperature Alarm	User-defined temperature threshold, audible and visual alarm of above/below temperature			
Image Format	Standard JPEG, including raw temperature data			
Long-Time Online Measurement				
USB	Transfer fully-radiometric thermal video stream with all original temperature data of each pixel to PC, connect with mobile devices supporting OTG (On-The-Go host)			
Continuous Online Monitoring	N/A	Support	N/A	Support
Professional Function				
Display Mode	Thermal image, customer size/transparency/moveable dual vision fusion picture-in-picture			
Image Saving Modes	Single thermal image / Thermal & digital image			

	FOTRIC 225	FOTRIC 226	FOTRIC 227	FOTRIC 228
Professional Function				
Take fully-radiometric Thermal Video Stream on Smartphone	Support, user-defined frame rate (up to 5 fps) or frame interval, up to 1,000 frames per video stream on smartphone			
Take fully-radiometric Thermal Video Stream on PC	N/A	Support	N/A	Support
Thermal Image Analysis on Smartphone	Support			
Thermal Video Analysis on Smartphone	Support			
Image Tagging / Labeling	Thermal image can be automatically labelled by scanning QR code or barcode			
Image Annotation	Voice / Text Memos			
Power Supply				
Battery Type	Rechargeable Lithium-ion			
Battery Operating Time	10 hours			
Charging System	AC Power Adapter			
Charging Voltage	12V DC Charger			
Environment				
Operating Temperature	-20℃ ~ +50℃			
Storage Temperature	-20℃ ~ +50℃			
Humidity	< 90%RH			
Physical Parameters				
Enclosure Rating	IP40			
FCC Certification	CFR 47 Part 15.107 CFR 47 Part 15.109			
Tripod Mounting	UNC1/4″-20			
Weight	~615g			
Dimensions (LxHxW)	118×145×93.5mm			
Warranty	2 years			
Software And App				
· FOTRIC AnalyzIR, professional computer analysis software			· FOTRIC LinkIR, smartphone App	
Standard Configuration				
· Thermal imaging camera (built-in battery) · Standard infrared lens · Lens protective case · Power adapter · USB to micro USB OTG cable (left angle / right angle)		· USB to Micro USB OTG cable · USB to Micro USB-C OTG cable · USB to USB cable · Hand wrist strap · Getting started manual (with warranty card) · Calibration certificate		
Optional Test Bench				
· FOTRIC B3s Universal test bench · FOTRIC Rc2 Rigid carry case for Fotric 220 series · FOTRIC Bg1 Pouch shoulder bag				

Optional Thermal Lens

	Equipment Type	Optional Lens
	Fotric 225 (with standard lens and up to 2 optional lens)	L13-225 telephoto lens, FOV 13°×9° L40-225 wide-angle lens, FOV 40°×30° L76-225 wide-angle lens, FOV 76°×57°
	Fotric 226 (with standard lens and up to 2 optional lens)	M30-226 macro lens, resolution 30μm (Calibrated range -20~150°C) M50-226 macro lens, resolution 50μm (Calibrated range -20~150°C) M100-226 macro lens, resolution 100μm (Calibrated range -20~150°C) L07-226 telephoto lens, FOV 7°×5° L15-226 telephoto lens, FOV 15°×11° L47-226 wide-angle lens, FOV 47°×35° L91-226 super wide-angle lens, FOV 91°×71°
	Fotric 227 (with standard lens and up to 2 optional lens)	L06-227 telephoto lens, FOV 6°×4.5° L14-227 telephoto lens, FOV 14°×10° L35-227 wide-angle lens, FOV 35°×26° L72-227 super wide-angle lens, FOV 72°×54°
	Fotric 228 (with standard lens and up to 2 optional lens)	M50-228 macro lens, resolution 50μm (Calibrated range -20~150°C) M20-228 macro lens, resolution 20μm (Calibrated range -20~150°C, accuracy ±5°C or ±5%) L08-228 telephoto lens, FOV 8°×6° L17-228 telephoto lens, FOV 17.6°×13.3° L45-228 wide-angle lens, FOV 45°×33.8° L92-228 super wide-angle lens, FOV 92°×76°

FOTRIC B3s Universal R&D Test Bench



R&D Test Bench

FOTRIC B3s

Compatible FOTRIC Thermal Cameras

Fotric 225, Fotric 226, Fotric 227, Fotric 228

FOTRIC 220 series thermal camera used in research papers published on the world's most authoritative magazines, such as Nature and others



ARTICLE

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Photothermal therapy with immune-adjutant nanoparticles together with checkpoint blockade for effective cancer immunotherapy

Qian Chen^{1,2}, Ligeng Xu^{1,2}, Chao Liang¹, Chao Wang¹, Rui Peng¹ & Zhuang Liu¹

ICG-R837, while the DC maturation percentages from mice treated with PLGA-ICG or free R837 (with the same dose) only increased to ~30 or ~35%, respectively. Therefore, PLGA-ICG-R837 nanoparticles showed even stronger *in vivo* immune-stimulation effect compared with the same dose of free R837, although the two induced similar levels of *in vitro* DC maturation (Fig. 1d and Supplementary Fig. 3).

DCs upon maturation would secrete various types of cytokines to regulate other types of immune cells³⁶. Thus, in the following experiment, various cytokines including interleukin 6 (IL-6) (an important marker in the activation of humoral immunity), tumour necrosis factor α (TNF- α) (an important marker in the activation of cellular immunity), and interleukin 12 (IL-12p70) (an important marker of innate immunity)^{37–42} in the mouse sera after different treatment were analysed by ELISA. It was found that mice treated with PLGA-ICG-R837 showed high serum levels of IL-12p70, IL-6 and TNF- α , which appeared to be higher than those in sera of mice treated with the same dose of free R837 (Supplementary Fig. 4). Such observed stronger *in vivo* immune-stimulation effect of PLGA-ICG-R837 than free R837 may be attributed to the sustained release of R837 from nanoparticles.

Photothermal tumour ablation for immune system activation.

On the basis of the aforementioned experiment results,

PLGA-ICG-R837 nanoparticles designed in our system is an effective immune-stimulator. It has been reported that many other ablative tumour treatments such as hyperthermia, photodynamic therapy and cryoablation will induce strong tumour-specific immune responses^{43–48}. Therefore, we wonder if photothermal therapy with our PLGA-ICG-R837 could trigger further enhanced immunological responses. Firstly, *in vitro* experiments verified that the residues of 4T1 breast tumour cells after NIR-induced photothermal ablation with PLGA-ICG-R837 could dramatically enhance the DC maturation, to a level much higher than that achieved by simply adding PLGA-ICG-R837 nanoparticles, or cell residues ablated by PLGA-ICG in the absence of R837 (Supplementary Fig. 2). Such results suggest that R837-containing nanoparticles could potentially act as an adjuvant to promote immunological responses of tumour-associate antigens in cell residues.

In our further *in vivo* experiment, BALB/c mice bearing subcutaneous 4T1 tumours were intratumourally (I.T.) injected with PLGA-ICG or PLGA-ICG-R837 and then irradiated by an 808 nm laser at the power density of 0.5 W cm⁻² for 10 min. As monitored by an infrared thermal camera (Fotric 225), the tumour temperature of mice injected with PLGA-ICG or PLGA-ICG-R837 under laser irradiation quickly rose to ~60 °C, which was high enough to effectively ablate tumours



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PEGylated Au@Pt Nanodendrites as Novel Theranostic Agents for Computed Tomography Imaging and Photothermal/Radiation Synergistic Therapy

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^{||}Printable Electronics Research Centre, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, Suzhou 215123, China

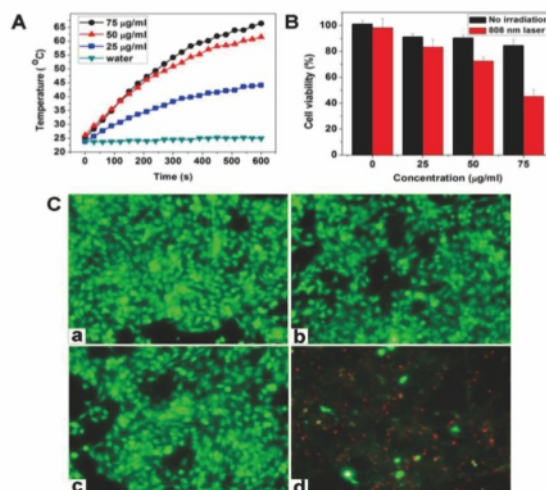
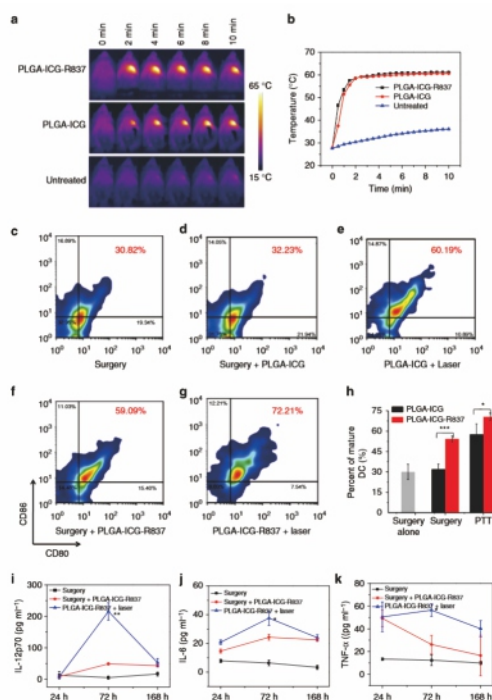
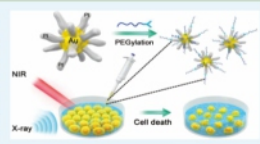
^{*}Institute of Functional Nano and Soft Materials (FUNSOM), Soochow University, Suzhou 215123, China

^{||}School of Radiation Medicine and Protection, School for Radiological and Interdisciplinary Sciences (RAD-X) & Collaborative Innovation Center of Radiation Medicine of Jiangsu Higher Education Institutions, Soochow University, Suzhou 215123, China

Supporting Information

ABSTRACT: The integration of photothermal therapy (PTT) with radiation therapy (RT) in a single nanoscale platform is believed to have considerable potential for cancer therapy. In this work, the rationally designed PEGylated Au@Pt nanodendrites (NDs) have been developed as a novel X-ray computed tomography (CT) and PTT/RT enhanced theranostic agent for cancer therapy. The absorption of Au@Pt NDs was turned to the near-infrared region with the growth of Pt nanobranched and thus enhances the efficacy of PTT. Furthermore, because of the high atomic number (high Z) of Au as well as Pt, Au@Pt NDs significantly enhanced lethal effects of RT by inducing a highly localized radiation dose within cancer cells. More importantly, the combination of Au@Pt ND-enhanced RT with PTT suppressed cancer cell growth more efficiently than RT or PTT alone did, indicating a synergistic effect. Meanwhile, the Au@Pt NDs also possess significant CT imaging signal enhancement that has the potential to guide PTT/RT for cancers. The integrated strategy significantly improved CT and PTT/RT of cancer cells with mild laser and radiation. Because of these advantages, Au@Pt NDs have become appealing and effective agents for cancer theranostic.

KEYWORDS: Au@Pt nanodendrites, computed tomography, photothermal therapy, radiotherapy, synergistic effect



Additionally, in comparison with rare earth and bismuth nanomaterials, Au and Pt nanomaterials have higher biocompatibility both *in vitro* and *in vivo*.^{37–39} Moreover, Au and Pt nanomaterials also exhibit good photostability and high photothermal conversion efficiency in PTT for cancers.^{40–42} It has also been proven that hybrid bimetallic nanoparticles exhibit optical and chemical properties better than those of single-element-containing nanoparticles.^{41–43} Therefore, we hypothesized that the combination of Au and Pt in one nanoscale platform could be a high-efficiency and low-toxicity

2.4. Photothermal Experiments of Au@Pt NDs. To study the photothermal effect of the synthesized Au@Pt NDs, 1 mL aqueous solutions containing different concentrations (0, 25, 50, and 75 µg/ml) of Au@Pt NDs were irradiated under an 808 nm laser at a power density of 1 W/cm² for 10 min. An IR thermal camera (Fotric 225) was used to record the temperature of the solution at each time point.

2.5. Cellular Uptake Assays. To determine the cellular uptake of Au@Pt NDs, the 4T1 cells were plated on a six-well plate and cultured for 24 h. Next, Au@Pt NDs (50 µg/ml) were added to each well for incubation in culture medium. At a determined time, PBS was used to wash the cells three times. A certain number of cells were collected to

About FOTRIC



Infrared thermal imaging technology can quickly measure the temperature distribution of the surface of the object and generate a thermal map of the temperature distribution. As a non-contact temperature measurement instrument, it helps R&D engineers optimize heat dissipation and improve product quality during the product development and quality verification.

FOTRIC integrates a professional-grade infrared thermal camera with a smartphone to help users operate the infrared cameras more easily and quickly share test data with team members. As the innovative brand of ZXF laboratories in Dallas Texas focusing on precision testing equipment innovation, FOTRIC thermal technology independently developed the thermal imaging equipment with built-in early fire detection/alarm intelligent algorithm, and officially launched the cloud-based thermal camera in 2017, marking the birth of the fourth generation of infrared thermal camera.

FOTRIC thermal imaging technology is committed to the global collaborative R&D of the innovative technology, enhance the safety of our lives, improve the efficiency of work, and turn on the infrared thermal imaging world for 123,456,789 people.



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