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Electron Paramagnetic Resonance Spectrometer

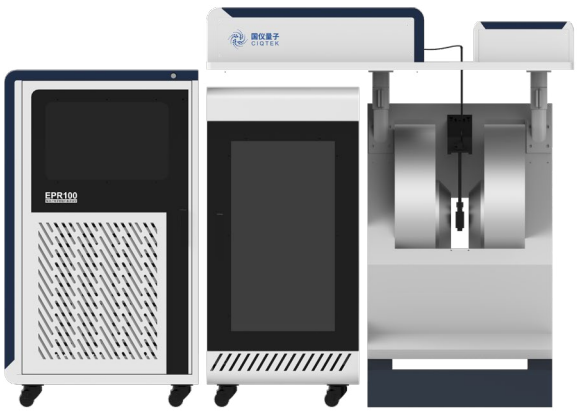
Electron Paramagnetic Resonance Spectrometer EPR100 Pulse EPR

Product Introduction

Electron Paramagnetic Resonance (EPR) spectroscopy is a method for studying the structure, dynamics, and spatial distribution of unpaired electronic matter. It can provide in-situ and non-destructive information such as electron spins, orbits and nuclei at the micro-scale.

When a substance containing unpaired electrons is placed in a static magnetic field, if a certain frequency electromagnetic wave signal is applied to the sample, the substance's emission or absorption of electromagnetic wave energy will be observed. By analyzing the law of change to the electromagnetic wave signal, the characteristics of the electron and its surrounding environment can be briefly analyzed, so that the analysis of the material structure and other applications can be performed.

Substances containing unpaired electrons are widely distributed, such as isolated single atoms, conductors, magnetic molecules, transition metal ions, rare earth ions, ion clusters, doped materials, defective materials, biological free radicals, metal proteins, etc .; many substances do not contain unpaired electrons, but will generate unpaired electrons when excited by light. Therefore, electron paramagnetic resonance technology is widely used in physics, chemistry, biology, materials, industry and other fields.



Product Features

1. Comprehensive functions, suitable for general continuous wave and pulse EPR measurement
2. Diverse experimental scenes to meet experimental needs such as light, low temperature, and corners
3. Magnetic field uniformity is better than 10 ppm， stability better than 10 mG/h
4. Microwave pulse time resolution up to 50 ps, improving spectral line resolution in pulse mode
5. High-performance solid-state power amplifier: 450 W output power
6. Unlimited number of pulses sequencer, suitable for dynamic multi-pulse decoupling technology
7. High-performance pulsed EPR probe with π / 2 pulses down to 8 ns
8. Absolute spin number sensitivity:
   3×10^{9} spins/(G· √Hz)

EPR100	
1D magnetic field scanning	Echo / FID measurement
2D magnetic field-microwave power scanning	Relaxation time measurement
2D magnetic field-modulation amplitude sweep	Sweep echo detection
2D magnetic field-time scanning	Electron-electron double resonance experiment
Variable temperature experiment	Electron-nuclear double resonance experiment
Light experiment	

Product Parameters

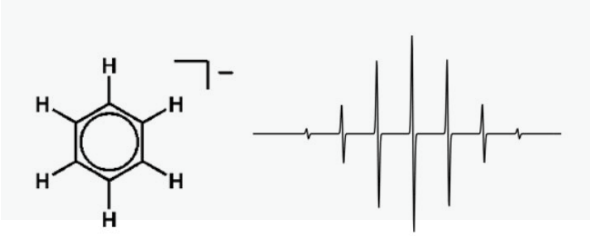
◆ EPR100

Parameters	Values
Microwave Source	Low noise solid wave source
Frequency Range	9.2-9.9 GHz
CW Microwave Power	Source of waves power 700mW, microwave bridge 200 mW
Microwave Power Attenuation	0-60 dB，Stepping 1 dB
Modulation Field Frequency	100 kHz，50 kHz，25 kHz，12.5 kHz，6.25 kHz
Modulation Field Amplitude	20 Gauss Max
Maximum Magnetic Field	0.7 T (1.5T optional)
Magnetic Field Uniformity	Better than 10 ppm@10 mm×10 mm×10 mm area
Magnetic Field Stability	Better than 10 mG/h
Low Temperature System Temperature Range	4 K - 300 K or 100K - 475K
Pulse Channel	Channel No.: **8**
	Channel 1: 0° Phase pulse (+X)
	Channel 2: 90° Phase pulse (+Y)
	Channel 3: 180° Phase pulse (-X)
	Channel 4: 270° Phase pulse (-Y)
	Channel 5: Solid state power amplifier gate signal
	Channel 6: Receiver low-noise protection switch control signal
	Channel 7: used for ELDOR experiment
	Channel 8: For expansion
Microwave pulse time resolution	50 ps
Solid-state power amplifier output power	450 W Max
Microwave pulse phase stability	Less than 3° in 1 ms
Maximum microwave pulse length	3 ms
Minimum π / 2 pulse length	8 ns
Arbitrary waveform pulse modulation	Sampling rate 1 GSPS

Product Applications

◆ Free radical research

Free radicals refers to atoms or groups with unpaired electrons formed by the homogeneous splitting of covalent bonds, when molecules of a compound under external conditions such as light and heat. Free radicals are very active and closely related to the aging of the human body and diseases. Electron paramagnetic resonance technology is currently the only method available for the direct detection of free radicals.

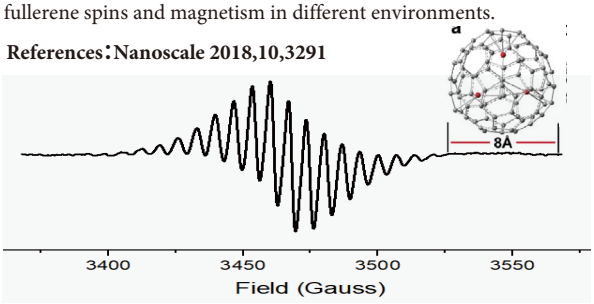


Benzene radical structure and its EPR spectrum

◆ Material science

Paramagnetic metal fullerene has important applications in magnetic resonance imaging, single molecule magnets, spin quantum information as a new nano magnetic material, we can obtain electron spin distribution in the metal fullerene by electron paramagnetic resonance technology, which can figure out interaction between the metal spin and magnetic core, and detect the changes of the metal fullerene spins and magnetism in different environments.

References：Nanoscale 2018,10,3291

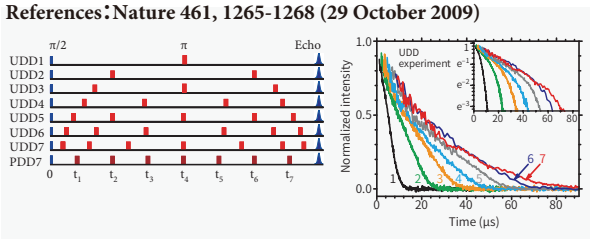


Sc3C2@C80 molecular structure and its EPR spectrum

◆ Quantum computing

Electron spins in solid-state systems are one of the important carriers of qubits for quantum computing research. Pulsed paramagnetic resonance technology can realize the preparation, manipulation, and readout of the electronic spin quantum states, thereby performing quantum computing Research on important issues. Scientists use optimal kinetic decoupling technology to increase the decoherence time of electron spins in solid-state systems, increasing the electron spin decoherence time in malonate single crystals irradiated with gamma rays from 0.04 μs to 30 μs, showing the significance of the kinetic decoupling technique.

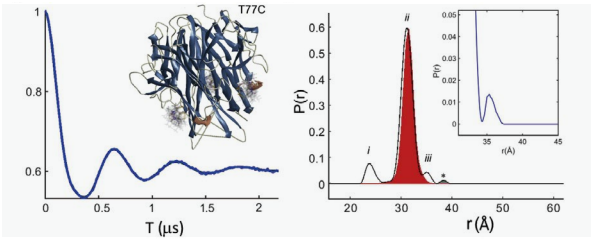
References：Nature 461, 1265-1268 (29 October 2009)



◆ Biological structure analysis

Double electronelectron resonance technology is one of the important tools for biological structure analysis. Using electronic spin labeling technology to specifically label biomolecules such as proteins and RNA, and measuring the electron-electron interaction strength by using electron paramagnetic resonance technology, it can provide distance information between labeled sites, so that biological structure Parsing. The technology can be used to measure distances between 1.7 and 8 nm with a non-destructive detection method.

Referance：Biophysical Journal 113, 371–380, July 25, 2017



◆ Irradiated food monitoring

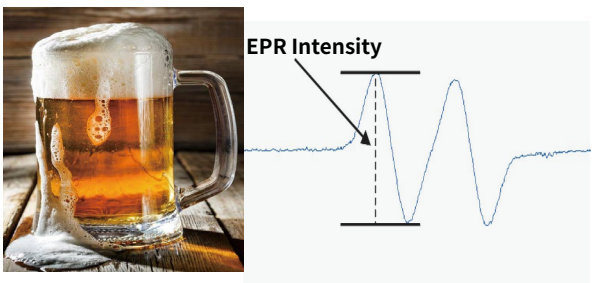
Food irradiation technology plays an irreplaceable role in ensuring food hygiene, safety, reducing pollution and chemical residues. Under the action of ionizing radiation in food, the covalent bonds of internal compounds are homogeneously split to generate a large number of free radicals. Electron paramagnetic resonance technology relies on the detection of long-lived free radicals generated by irradiation to identify irradiated foods, such as cellulose Irradiated food containing bone, bone and crystalline sugar.

标准中文名	标准号
ESR波谱法-含纤维素辐照食品的检测	DB32/T 1269-2008 ESR
ESR波谱法-含结晶糖辐照农产品的检测	DB32/T 2554-2013
出口辐照食品检测方法 电子自旋共振波谱法	SN/T 2910.1-2011
辐照含骨类动物源性食品的鉴定—ESR法	NY/T 1573-2007

Information source: National Standard Information Public Service Platform (http://std.samr.gov.cn)

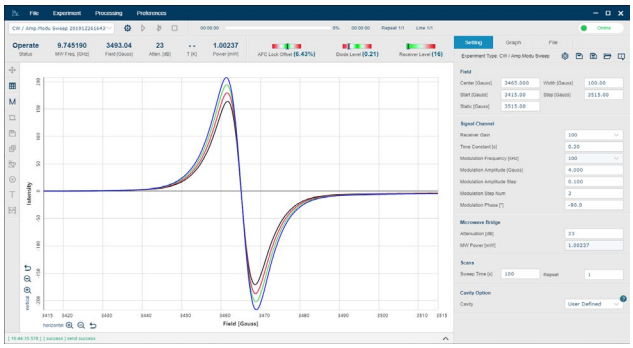
◆ Beer industry

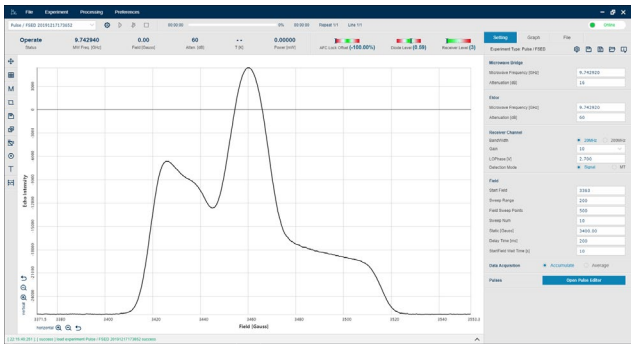
During the beer preservation process, the free radicals after being oxidized cause the beer to deteriorate, and heating will effectively accelerate the oxidation; the electronic paramagnetic resonance spectrometer, as a detection tool for beer oxidation performance, can monitor the changes of free radicals in the beer brewing process and predict the finished product. The flavor freshness period of wine, comprehensive evaluation of beer flavor stability.



Software & Affiliated

◆ Software : EPR-Pro





Software Features

01 Modern design style, simple and elegant interface

02 Scientific data analysis function

03 Compatible with continuous wave and pulse modes

04 Automatic experiment report generation

05 Automatic parameter adjustment and optimization

06 Separate data analysis software for offline use

◆ Affiliated

Liquid nitrogen variable temperature

Liquid nitrogen dewar

Light system

Standard sample

4 mm outer diameter sample tube, flat cell

automatic goniometer