A300/A200

- The Backbone of EPR

A300/A200 Spectrometer

Electron Paramagnetic Resonance (EPR) is a spectroscopic method that detects the presence of unpaired electrons in your samples. It can yield meaningful structural and dynamic information, even from ongoing chemical or physical processes without influencing the process itself. EPR is an ideal technique to complement other analytical methods in a wide range of application areas.

Biology and Medicine

- Spin label and spin probe techniques
- Spin trapping
- Dynamics of biomolecules using saturation transfer techniques
- Free radicals in living tissues and fluids
- Antioxidants, radical scavengers
- Contrast agents
- Oximetry
- Drug detection, metabolism and toxicity
- Enzyme reactions
- Photosynthesis
- Structure and identification of metal-binding sites
- Photochemical and radiolytic generation of radicals
- Oxygen based radicals
- NO in biological systems
- Carcinogenic reactions

Chemistry

- Kinetics of radical reactions
- Polymerization reactions
- Spin trapping
- Organometallic compounds
- Catalysis
- Petroleum research
- Oxidation and reduction processes
- Biradicals and triplets states of molecules

Physics

- Measurement of magnetic susceptibility
- Transition metal, lanthanide, and actinide ions
- Conduction electrons in conductors and semiconductors
- Defects in crystals eg color centers in alkali-halides
- Optical detection of magnetic resonance, excited states of molecules
- Crystal field in single crystals
- Recombination at low temperatures

Materials Research

- Degradation of paints and polymers by light
- Polymer properties
- Defects in diamond
- Defects in optical fibers
- Laser materials
- Organic conductors
- Influence of impurities and defects in semiconductors
- Properties of magnetic materials
- High Tc superconductors
- C60 compounds
- Behavior of free radicals in corrosion

Industrial Applications

- Dosimetry for irradiation pro cessing
- Shelf life prediction in beer
- Vegetable oil freshness
- Radical detection in irradiated polymers
- QC of high grade optical glass
- Oxidative resistance in automobile paint
- Filter efficacy in cigarettes
- Defect centers in semiconductors

Non-Destructive, Non-Intrusive, Versatile

The A300 und A200 Spectrometer Series is Bruker´s answer to scientific demands and economic budgets. The A300 is based on a modular concept whereas the A200 is a compact, highly integrated system. Both spectrometers were designed as verstile instruments for the study of electron paramagnetism in a wide range of gaseous, liquid and solid samples. The versatility and flexibility of instrumentation and operational modes make the A-Series equally suited for both routine work and high sophisticated research.

The A300 and A200 deliver the highest sensitivity in their class. The newest digital technique is used to improve the user interface of the spectrometer and to support the operator with a variety of software and hardware tools. These spectrometers are the latest products of Bruker´s EPR development team that has set the world standards in EPR since more than 25 years.

A300/A200 Components

Microwave Bridge

The A300/A200 bridge incorporates the latest microwave technology to provide high sensitivity and and easy of operation.

- Remotely controlled via PC
- Output stepped in 1 dB increments from 0-60 dB
- Direct digital power readout
- High dynamic range AFC frequency locking
- Frequency counter

Power Supply

The unsurpassed stability and reliability of Bruker power supplies provide the ground work necessary of high performance, high resolution spectroscopy. High operating reliability is guaranteed not only through rigorous check-out control procedures, but also by carefully selecting the electronic components and eliminating all elements having high risk factors. In many years of experience, the average failure rate is less than 0.3% per annum.

Magnets

Through computer aided design and simulations, the Bruker line of magnets are optimized for field homogeneity, maximum field strength, and unequaled efficiency. The material consists of magnetically soft, pure steel of low C-, P-, and S-content. The magnets feature indirect cooling and can be run without heat exchanger. Safety is guaranteed by water control, thermal control and current control interlocks. The A300 and A 200 are compatible with all Bruker EPR electromagnet systems.

Highest Resolution and Sensitivity

The new Generation of Signal Channel & Field Control makes use of an 18-bit sigma-delta technology to achieve unprecedented combination of stability and resolution. Only the "heart" of the devices remains analog. Both the frequency synthesis as well as the detection is performed digitally, ensuring maximum phase stability.

Signal Channel

The practical advantage of the higher digitizer resolution independent of measuring speed means that even when the gain is not optimally set, signals can be fully recovered. 2D Experiments during which the signal intensity changes can be made without changing gain. The new signal channel features actually two completely independent channels allowing true simultaneous acquisition of either 1st & 2nd harmonic spectra, in- and out-of -phase spectra, or absorption & dispersion spectra.

Field Controller

The use of true 18-bit field setting resolution means that there is no practical difference between sweep and static field modes, since a sweep is simply a sequence of static field values. These don´t necessarily have to be linear or continuous allowing totally new experiments that optimize sweep time for particular kinds of spectra. There are no discontinuities when switching from static to sweep modes and the same precision applies throughout. The use of digital PID temperature control ensures unsurpassed long term field stability.

Sensitivity

The sensitivity of an EPR spectrometer is one of the most important parameters. Since more than 25 years Bruker has set the international sensitivity standard which has never been reached by any other manufacturer of EPR instrumentation. The S/N depends on a variety of construction details starting with the microwave source, the detector system, the electronic and microwave shielding, the probe heads and in particular the individual specification of each building block. The A300 and A200 spectrometers feature the highest sensitivity in their class, measured with a weak pitch signal to noise of 1500 to 1.

Resonator

The A300/200 Series can be equipped with a variety of resonators and probe heads in order to find the optimum solution for a particular application. The basic version features the Standard High Sensitivity Cavity with Optical Window, automatic tuning and automatic matching. This resonator is for general use and is compatible with the variable temperature units for nitrogen and helium.

The Xenon Software Suite

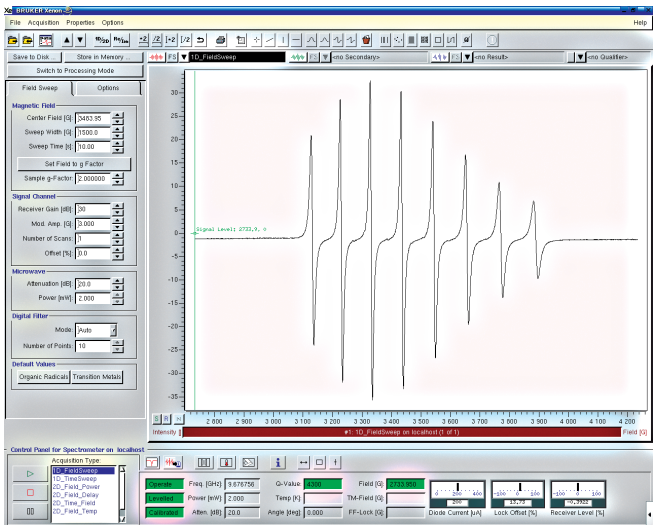
The Xenon software is the EPR software solution providing the answer for reliably and reproducibly acquiring CW-EPR data without the need of an expert. Xenon offers a modern software solution for acquisition and processing of CW-EPR spectra.

The Xenon Software Suite

Xenon is a full suite for EPR data acquisition, processing, and analysis. Xenon guides the user from beginning of acquisition through analysis with various targeted workflows.

Acquisition

- Fully calibrated system for quantification
- Automatic sweep resolution
- Automatic accessory recognition



Processing Routines Cover all Aspects of EPR

- Baseline correction
- g-factor reading
- Distance reading
- Peak-picking
- Double integration
- Digital filtering

Data analysis routines

- SpinCount
- SpinFit
- Spin trap library
- $P_{1/2}$ Analysis

The Xenon World for CW-EPR

- Linux based CW-EPR software package
- Integrated acquisition and processing
- Easy to learn & easy to handle
- Spin counting module included
- High precision double integration tool
- Auto resolution setting

Quantitative EPR Package

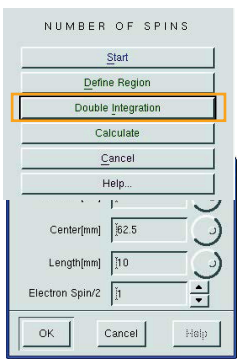
Quantification and identification, the most demanded but challenging analyses in EPR, have become easy tasks with Bruker´s SpinCount and SpinFit.

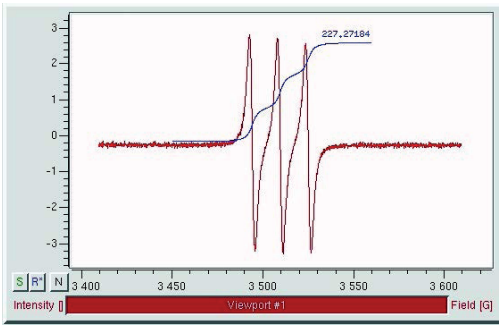
SpinCount for Quantitative EPR

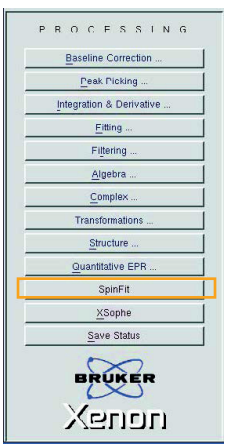
- Single measurement
- No reference sample required
- No need for calibration
- Works with all sample types
- Works at all temperatures

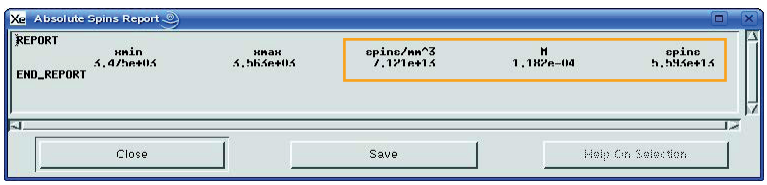
SpinFit for Identification

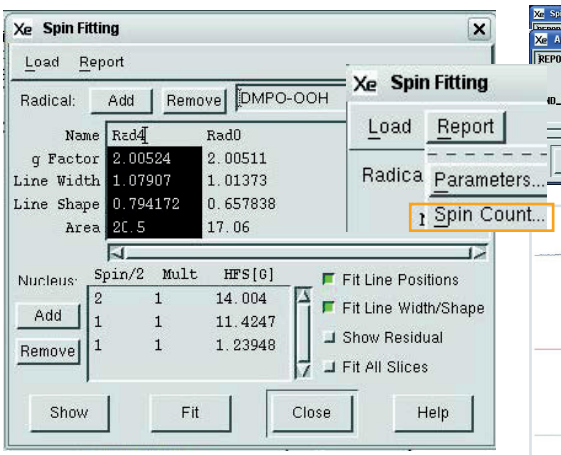
- Spectrum simulation and fitting for isotropic and anisotropic signals
- Extensive spin-trap library for quick identification
- Library for common EPR solid species
- Integrated SpinCount quantification

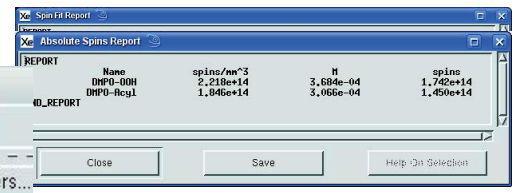


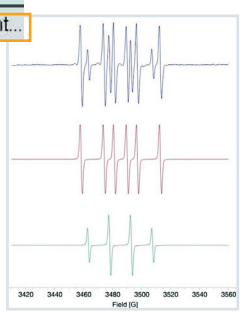












Advanced Acquisition Modes

Predefined experiment set-ups for user guided 1D and 2D acquisitions.

Acquisition Modes

- Field Sweep
- Time Sweep
- Field vs Time
- Field vs Power
- Field vs Temperature
- Field vs Sample Angle
- ENDOR

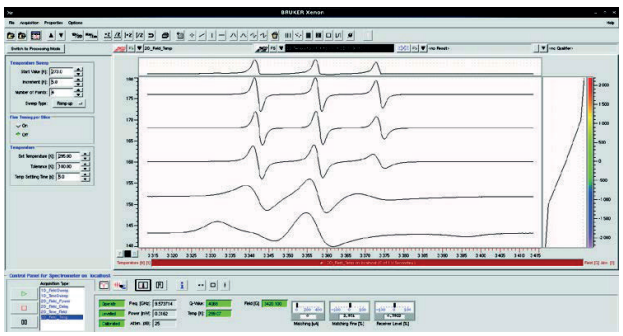


Figure 1: 2D experiment field vs temperature for monitoring the evolution of the EPR spectrum as a function of temperature

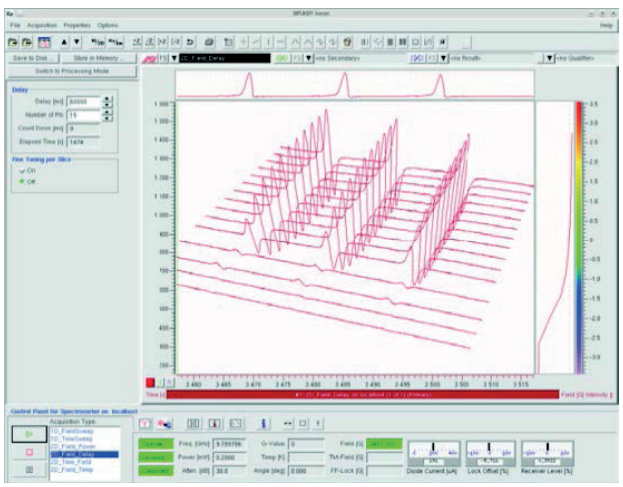


Figure 2: 2D experiment field vs temperature for monitoring the evolution of the EPR spectrum as a function of temperature

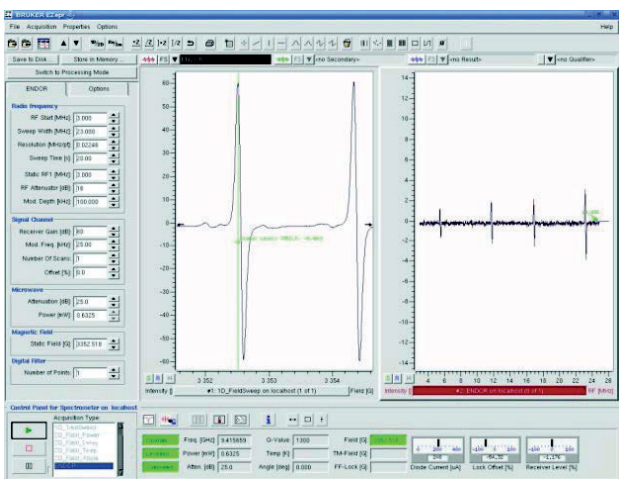


Figure 3: Split screen display for convenient selection of field positions for ENDOR spectrum acquisition

Special Purpose Cavities

ER 4117 MX

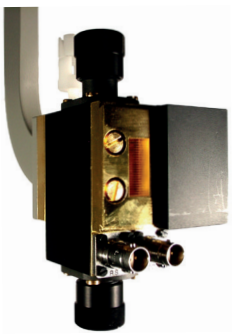
A continuous flow mixing resonator designed for the detection of short-lived radicals formed during biochemical/chemical reactions. The small sample volume insures minimal consumption of limited reactants.

ER 4105 DR

A double cavity resonator for applications requiring comparison against a reference standard. Ideal for spin concentration determinations as well as the measurement of g-values.

ER 4116 DM

A dual mode resonator designed for anisotropic studies of triplets, biradicals, transition metal and rare earth ions containing "forbidden" fine structures or hyperfine structure transitions.



ER 4102 ST

A universal rectangular resonator with the flexibility suited to a wide variety of EPR studies. A temperature range up to 700 K is possible with the addition of water cooled side plates.

ER 4104 OR

An optical transmission cavity designed for combined EPR and optical spectroscopy for studies correlating the EPR signal with the optical spectrum. The optical transmission path is 4 x 10mm. All standard temperature control systems can be used.

ER 4103 TM

A flat cylindrical cavity resonant in the TM110 mode with a nominal center frequency of 9.8 GHz and an unloaded Q of 12.000. The cavity is designed to accept flat cells of large width as used for aqueous solution EPR. This cavity is particular useful for investigation of samples with dielectric loss under temperature control. Special flat cell holders have been constructed to center the cell in the cavity. The cavity features an optical access with a transmission of 80%.

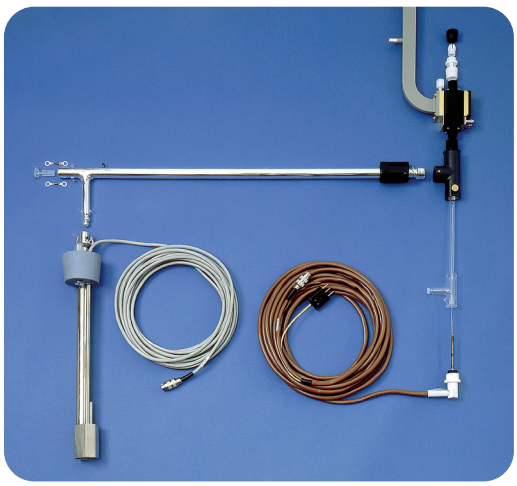
Accessories

Temperature Controllers

Bruker offers a number of options for variable temperature operations. Here is a sampling of some of the temperature control systems available.

A 4112 HV

Range: 3.8-300 K. – Stability: +/- 0.1 K (below 20K)
Continuous flow liquid helium cryostat. Includes a cooled transfer line, electronic controller, gas flow components, pumps and support brackets. The relative simplicity of the sample cooling unit provides for quick cool-down and easy sample handling.

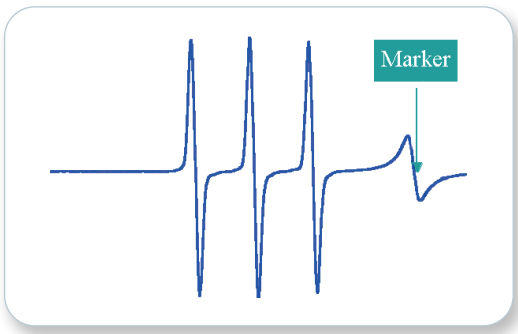


A 4141 VT

Range: 100-500 K. – Accuracy +/- 0.1 K.
Digital temperature control unit for nitrogen, suitable for all spectrometer configurations.
It is constructed as an evaporator system using only liquid nitrogen and comprises a digital control unit, flow meter, cavity insert dewar, transfer dewar, evaporator, a storage dewar, thermocouple, heater system, and mounting brakkets.

E 4100 MK

Intensity / g-Factor Marker
Accurate g-value determinations and quantitative EPR measurements require an EPR marker with a non-interfering g-value, minimal power, saturation, and dynamic amplitude adjustments. Bruker provides a marker which meets all of these criteria. A g-value of 1.9800 and a line width of 2 G insure minimum overlap with free-radical signals. The signal amplitude is adjustable over a 40 dB dynamic range and exhibits minimal saturation at high power. The marker attaches to the front of the EPR cavity and is designed for RT and VT measurements.



Bruker BioSpin

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