Learning EPR with Magnettech ESR5000: **Giving Students Hands-on Experience**



Enhance your curriculum with an affordable and easy-to-use bench-top EPR instrument and open career doors for your students in fields such as biology, chemistry, medical science, materials science, forensics, etc. by teaching them the versatile technique of electron paramagnetic resonance (EPR) spectroscopy. The Magnettech ESR5000 is ideally suited for educational applications in EPR. The instrument offers research-grade results in a compact, portable design that features the user-friendly ESRStudio software.

Educational Kit for the Magnettech ESR5000

- EPR Primer with introduction to the basic theory and practice
- Suite of experiments for teaching EPR data acquisition and processing skills (with full instructions)



- Real life sample analysis in the classroom
- Lab accessory kit



nnovation with	Integrity

Fig. 1: Educational kit for Magnettech ESR5000

Why Choose the Magnettech ESR5000?

Any customer can confidently add or enhance their lab with real world EPR:

- Easy-to-use X-band continuous wave bench-top EPR spectrometer fully optimized for a magnetic resonance teaching environment
- Rapid automated tuning and measurement
- Dedicated recipes for various experiments and analysis
- Availability of versatile accessories
- Fully calibrated for quantitative analysis:
 - SpinCount Reference free quantification of EPR species (Bruker patent)
 - SpinFit Liquids Simulation and fitting of radicals and transition metal species in liquid state
- Spectral library of common species for radical identification



Variable Temperature Unit

Fig 2: Magnettech ESR5000 and accessories

Educational Kit Experiments At-A-Glance

- Acquiring spectra: introduction to ESRStudio software with pre-selected parameters (recipes) and sample preparation
- **Real life samples:** students will run spectra on samples found in their everyday environment that contain radicals such as coffee, tea, cocoa, spices, etc.
- Acquisition parameters: effect of acquisition parameters such as microwave power, modulation amplitude, center field, sweep width, digital filtering, etc. on the
- **Quantitative EPR:** learning the basics of quantitative EPR and how to perform relative quantification using a reference sample or using reference-free SpinCount module





Spectrometer Parameters

Building a Saturation Curve and P_{1/2} Analysis

After finishing the measurement series, mark the folder in the Measurement list containing the data, click on Show Evaluation View and select Power saturation level Click Create to build a saturation curve (Amplitude over square root of microwave power) and determine $P_{1/2}$ value. $P_{1/2}$ is the microwave power giving the half maximum amplitude and is the recommended value to use for any EPR measurement while doing quantitative





Fig. 5: Optimizing microwave power



Figure 6.1: Optimizing B0 (center field) and Sweep Width

Record spectra for different modulation amplitude values.

Once the value for B₀ and sweep are optimized change the series type from Single measurement to Amplitude modulation sweep. Acquire spectra from 0.05 mT to 1 mT with step count 10:

mΤ

Fig. 6: Quantitative EPR

Conclusion

With Magnettech ESR5000 educational kit, introducing EPR to the next generation is easier than ever.

EPR spectra, and how to optimize those

- **EPR fingerprints:** understanding the basics of EPR theory and how to determine g-factor and nuclear interactions with the unpaired electron in free radicals and transition metals
- Kinetics: monitoring radical reactions and using forced oxidation as a quality control analysis



Fig 3: Sample handling





Fig. 4: Optimizing modulation amplitude

- EPR theory and practical spectrometer control is presented with real world examples and samples.
- As the only technique to detect species with unpaired electrons, EPR crosses many disciplines, such as biology, chemistry, physics, medical science, and material science, opening career options.

