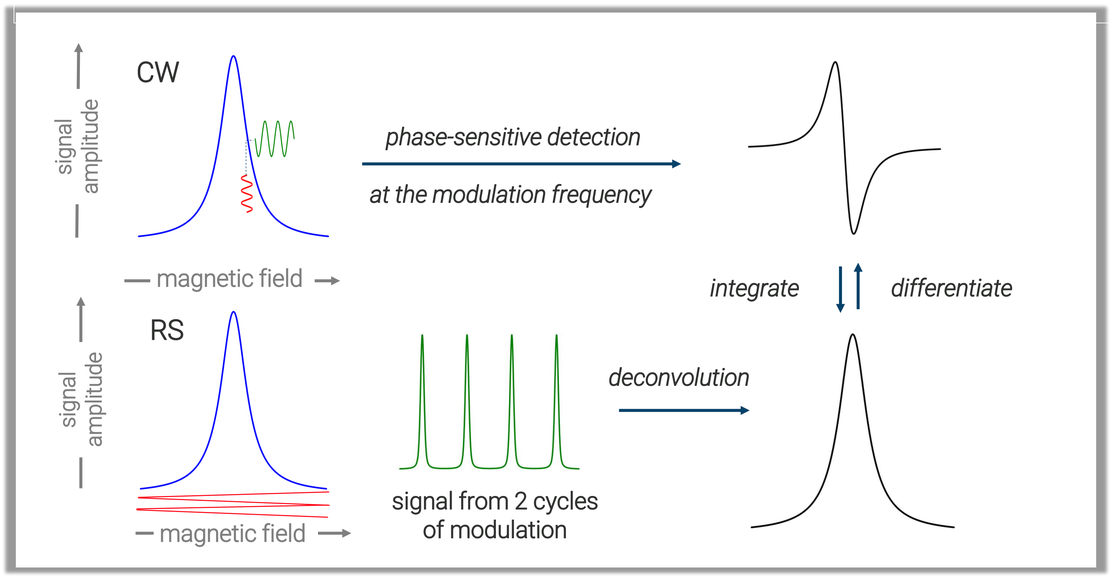
Rapid Scan EPR: a new approach for kinetics

Challenges and solutions:

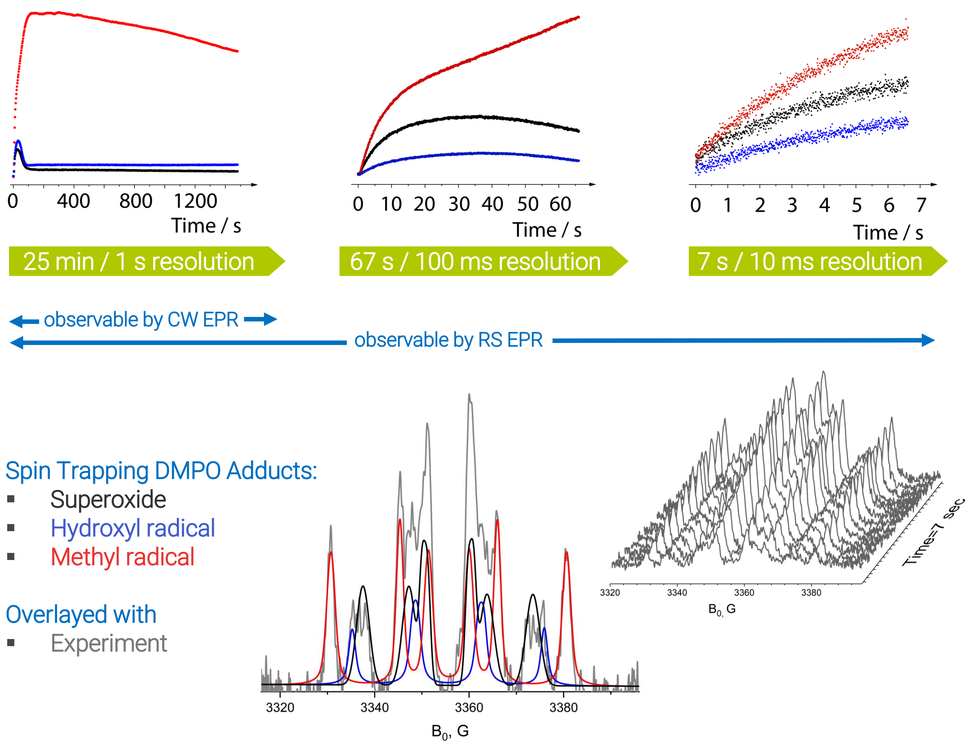
- RS EPR offers superior sensitivity and bandwidth compared to pulsed EPR
- RS EPR opens shorter timescale measurements relative to CW EPR
- RS EPR investigates fast reactions by observing rapid changes in the full EPR spectrum and monitors kinetics of multiple species simultaneously
- The Bruker Rapid Scan accessory enables time resolutions down to 10 µs

CW vs RS EPR



- In RS-EPR, the magnetic field is swept over a range larger than the signal line width and the signal is directly observed via quadrature detection as absorptive line shapes.
- In CW-EPR the field modulation is applied only to a small fraction of the spectrum, yielding a derivative line shape.

Light induced complex kinetics: Zooming in on multiple timescales

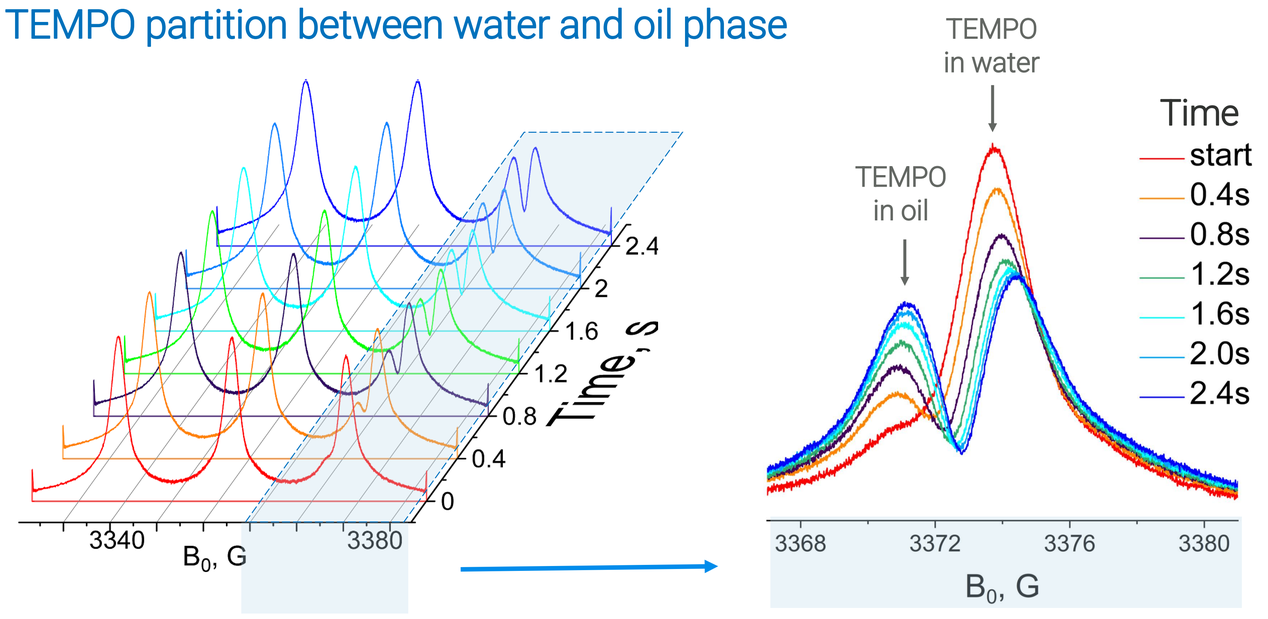


Kinetics of three spin-trapping adducts with DMPO (superoxide (black), hydroxyl (blue) and methyl (red)) on three different time scales for radicals emerging upon UV-irradiation of TiO_2 nanoparticles suspended in DMS.
The overlapping individual components were analyzed and quantified using SpinFit Liquids.

RS Resonator

- Optical access via light fiber with a high power SMA 200 µm connector
- Variable Q-value of 500-6000 at critical coupling
- Critical coupling up to 500 mW
- Fully compatible with He and N_2 VT units

TEMPO partition between water and oil phase



Kinetics of redistribution of TEMPO between water and oil phases after addition of disperse di-butyl phthalate phase (15% vol.) to a 1 mM solution of TEMPO in water/D_2O.

Conclusion

- The Bruker RS-EPR accessory offers unique insights into kinetics
- RS-EPR monitors amplitudes and lineshape changes on a microsecond timescale
- Kinetics of multiple species in RS-EPR spectra can be analyzed using SpinFit Liquids
- The RS-EPR accessory is available for ELEXSYS and EMXplus spectrometers

Technology