INNOVECTIS
Ein Unternehmen der
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Double resonance structures for NMR and EPR measurements

Project Status

A prototype of the invention has been designed and tested.

Customer Benefits

- Approx. 10-fold larger sample volume (200 nl) compared to known helix resonators
- Avoidance of overheating of the samples
- Increased signal sensitivity and spectral resolution for DNP and ENDOR.
- Faster measurements
- Easy to implement

Publications

- Denysenkov et al., Appl. Magn. Reson. 2008
- Prandolini et al., JACS 2009

Patents

- DE 10 2008 017 135
- DE 10 2009 048 636
- US 8,570,033
- US 8,823,373
- JP 5 399 551
- EP 2 269 045, validated in: DE, GB, FR, CH, SE, NL
- EP 2 414 820, validated in: DE, GB, FR, CH, SE, NL

The technologies can be licensed or assigned. Moreover, collaborations regarding further development are welcome.

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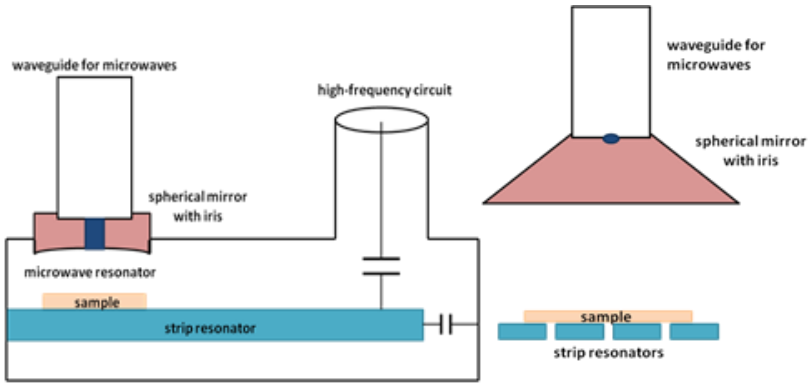
Abstract

NMR spectroscopy is one of the most important methods to elucidate the structure and dynamics of molecules. The sensitivity of the spectrometer is a limiting factor.

The present invention increases the signal sensitivity and spectral resolution. The new double resonance structure is suited for a combined NMR/EPR spectrometer for the investigation of liquid samples applying dynamic nuclear polarization (DNP) and/or electron nuclear double resonance (ENDOR) techniques.



Double-resonant structures with one strip resonator and a number of strip resonators

Invention

The new double-resonant structure consists of a strip resonator which generates high-frequency fields for NMR transitions and a microwave resonator for EPR transitions. Part of the strip resonator acts as a flat mirror and reflects irradiating microwaves quasi-optical. The open double-resonant structure offers enough space for measurements of samples with a volume up to 200 nl. The volume is about 10 times larger compared to known helix resonators.

Moreover the flat mirror acts as a sample plate, which can be used as a heat sink due to its good thermal conductivity. This allows investigations of liquid samples with a much larger volume.

The arrangement includes a spherical mirror. Through the iris of the mirror microwaves can be fed into the microwave resonator.

Simulations show that the new double-resonant structure generates an increased magnetic high-frequency signal. Additionally, a strong and very homogeneous magnetic microwave field within the sample is created. Therefore, the spectrometer provides a high signal sensitivity and high spectral resolution.

In an alternate setup the high-frequency resonator formed from a number of parallel arranged electrically conductive strips. Compared to the use of the single strip resonator the conversion factor is further increased. This provides a higher magnetic field strength and an increased NMR-measuring sensitivity is achieved.