DOUBLE RESONANCE STRUCTURES FOR NMR AND EPR MEASUREMENTS

Ref-Nr: TA-IN0063

HINTERGRUND

There exist double resonance structures for DNP and ENDOR measurements. These structures usually consist of a cylindrical microwave resonator, also called helix resonator, producing a high-frequency magnetic field which is required for the experiments.
However, the disadvantage of the known structures is their limited purpose sample volume. For one, they are limited because of the dimensions of the helix resonator which correlates to the wavelength of the excited microwave. Second, large volumes of liquid, particularly aqueous samples are heated up due to the microwave irradiation.

LÖSUNG

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 quasioptical. 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.

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ENTWICKLUNGSSTAND

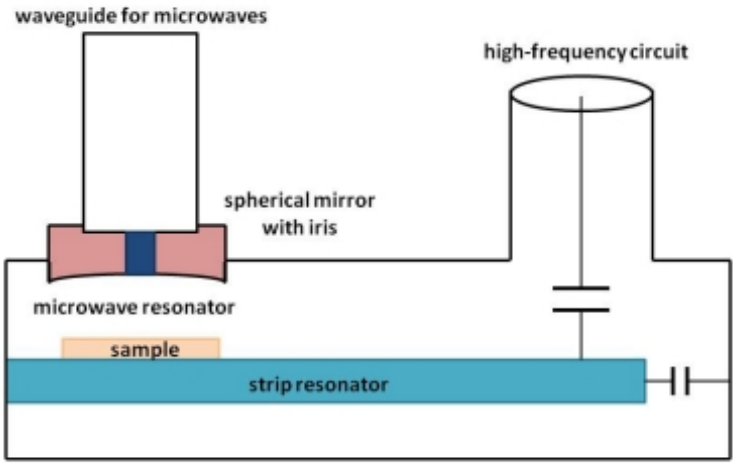
Prototyp

PATENTSITUATION

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

CATEGORIES

//Molekularbiologie, Genetik //Diagnostik //Rote Biotechnologie //Halbleiter //Medizin und Pharma //Medizintechnik //Chemie //Maschinenbau //Material- und Werkstofftechnik //Physikalische Technik //Sensorik und Messgeräte //Analytik //Bildgebende Verfahren //Life Sciences



Double-resonant structure with one strip resonator.

VORTEILE

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

ANWENDUNGSBEREICHE

DNP experiments

- structural analysis of biomolecules
- identification and monitoring of contaminants
- investigation of dynamic molecular interactions

ENDOR experiments

- investigation of defects in semiconductors
- investigation of chirality
- investigation of fullerenes

Wide application range from medical diagnostics to material science.

SERVICE

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

PUBLIKATIONEN & VERWEISE

[1] Denysenkov, V. P., et al. "High-field DNP spectrometer for liquids." Applied Magnetic Resonance 34.3 (2008): 289-299.

[2] Prandolini, M. J., et al. "High-field dynamic nuclear polarization in aqueous solutions." Journal of the American Chemical Society 131.17 (2009): 6090-6092.