MULTI-CHANNEL ZULF NMR SPECTROMETER USING OPTICALLY PUMPED MAGNETOMETERS

Tech ID: 33544 / UC Case 2024-125-0

PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO 2025/213106	10/09/2025	2024-125

BRIEF DESCRIPTION

While nuclear magnetic resonance (NMR) is one of the most universal synthetic chemistry tools for its ability to measure highly specific kinetic and structural information nondestructively/noninvasively, it is costly and low-throughput primarily due to the small sample-size volumes and expensive equipment needed for stringent magnetic field homogeneity. Conversely, zero-to-ultralow field (ZULF) NMR is an emerging alternative offering similar chemical information but relaxing field homogeneity requirements during detection. ZULF NMR has been further propelled by recent advancements in key componentry, optically pumped magnetometers (OPMs), but suffers in scope due to its low sensitivity and its susceptibility to noise. It has not been possible to detect most organic molecules without resorting to hyperpolarization or 13C enrichment using ZULF NMR.

To overcome these challenges, UC Berkeley researchers have developed a multi-channel ZULF spectrometer that greatly improves on both the sensitivity and throughput abilities of state-of-the art ZULF NMR devices. The novel spectrometer was used in the first reported detection of organic molecules in natural isotopic abundance by ZULF NMR, with sensitivity comparable to current commercial benchtop NMR spectrometers. A proof-of-concept multichannel version of the ZULF spectrometer was capable of measuring three distinct chemical samples simultaneously. The combined sensitivity and throughput distinguish the present ZULF NMR spectrometer as a novel chemical analysis tool at unprecedented scales, potentially enabling emerging fields such as robotic chemistry, as well as meeting the demands of existing fields such as chemical manufacturing, agriculture, and pharmaceutical industries.

SUGGESTED USES

» Multi-channel NMR spectroscopy

» High-throughput chemical analysis

» Pharmaceutical industry, robotic chemistry development, rapid quality control and screening, etc.

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

» **Engineering**
  » Engineering
  » Other
  » Robotics and Automation
» **Biotechnology**
  » Health
» **Energy**
  » Other
» **Materials & Chemicals**
  » Biological
  » Chemicals
  » Nanomaterials
  » Other
» **Medical**
  » New Chemical Entities, Drug Leads
  » Other
  » Research Tools
  » Screening
» **Agriculture & Animal Science**

ADVANTAGES

» Rapid multi-channel measurement scheme

» First reported detection of organic molecules in natural isotopic abundance by ZULF NMR

» Sensitivity approaching expensive, single-channel benchtop NMR spectroscopy

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- High-Precision Chemical Quantum Sensing In Flowing Monodisperse Microdroplets
- High-Speed, High-Memory NMR Spectrometer and Hyperpolarizer

» Chemicals

RELATED CASES

2024-125-0

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