MQC-R

A benchtop TD-NMR research instrument for materials analysis

Introducing MQC-R

The MQC-R is a highly configurable, benchtop time domain nuclear magnetic resonance (TD-NMR) instrument for flexible analysis of materials across academia and industry. Its modular design provides wide ranging options for varying sample temperature and pulsed field gradient packages to measure diffusion. Configurable with a range of nuclei (e.g., ^{1}H, ^{19}F) and probe sizes, MQC-R characterises important physical and chemical properties of samples across food science, chemical research, pharmaceuticals, cosmetics, polymers, batteries, construction materials, and many other disciplines.
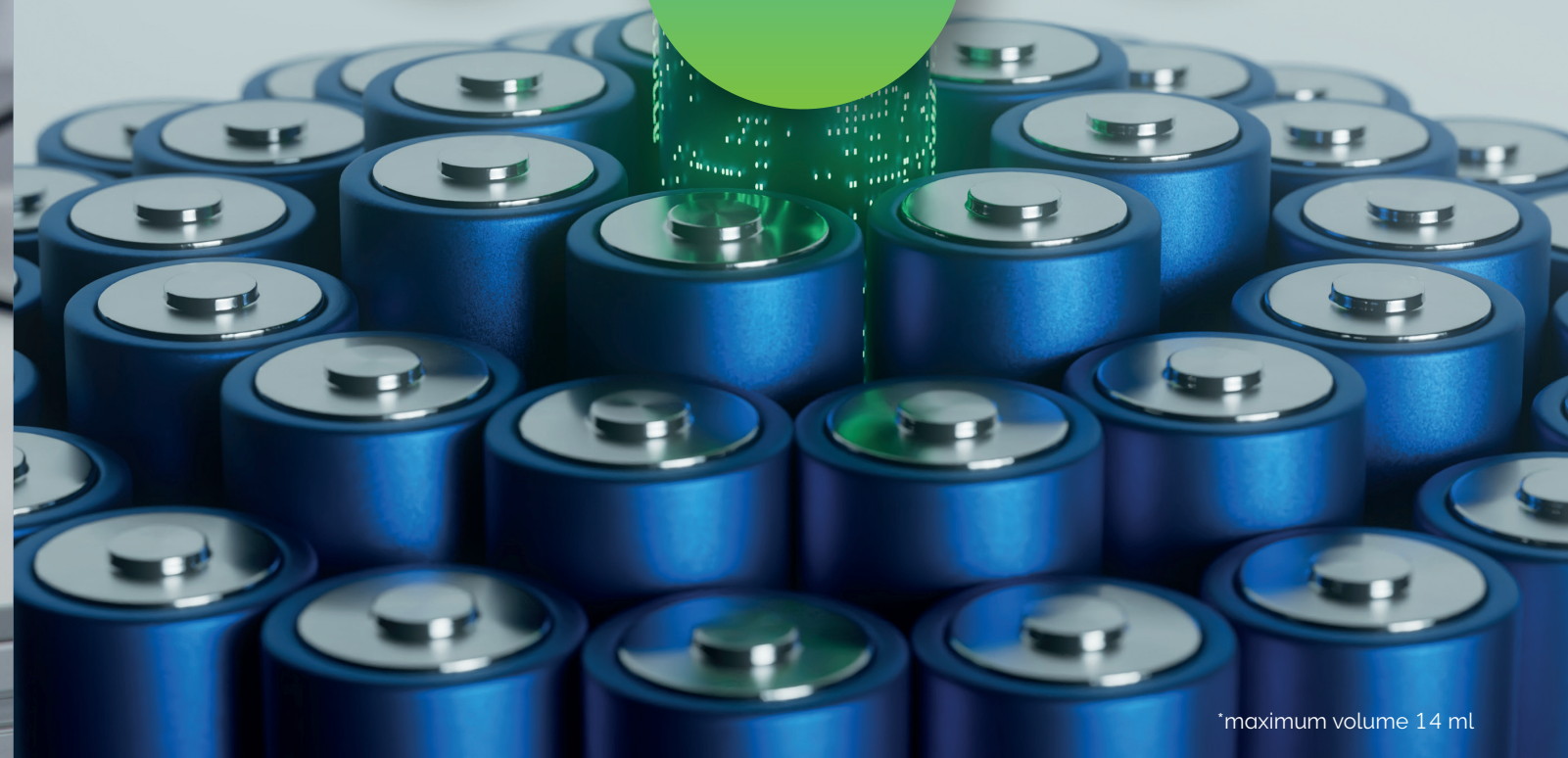
Why TD-NMR?

Unlike other techniques used to obtain the same sample properties, TD-NMR is non-invasive and non-destructive, often requires minimal sample preparation, and characterises both transparent and opaque samples. It does not require hazardous chemicals and can be used on a laboratory bench, moveable workstation, or near line in manufacturing.

Oxford Instruments has a long history of industry-leading TD-NMR research instruments, and provides comprehensive customer and applications support worldwide.

Uncover your material properties

- Crystallinity
- Phase transitions
- Water mobility and content
- Droplet and pore sizing
- Sedimentation
- Diffusion

MQC-R - flexible, non-invasive, non-destructive materials analysis

- Mobile workstation – easily move between locations
- Easy-to-use, customisable software with advanced measurements, e.g. 2D distributions
- 23 MHz magnet delivers fast, high sensitivity, TD-NMR analysis
- Highly configurable with modular upgrades
- Unique variety of interchangeable ^{1}H and ^{19}F NMR nuclei probes
- Pulsed field gradient NMR for diffusion, droplet size distribution, 1D profiles
- 10 - 26 mm diameter probes for a wide range of sample size*
- Liquid variable temperature option (-5 to 70ºC)

*maximum volume 14 ml

Selected measurements and applications:

The MQC-R can perform a wide range of experiments to determine many important sample properties.

### Food science and quality control:
- Droplet size distribution of dairy products and emulsions
- Microscopic water (and fat) distribution related to mobility and environment
- Phase transitions during heating/cooling, hydration/dehydration
- Water-macromolecule interactions e.g. protein concentration, aggregation, denaturation

Polymer research and quality control:
- Amorphous/crystalline content
- Curing and hardening
- Polymerisation reaction kinetics
- Morphology and molecular mobility

Pharmaceutical research:
- Concentration and state of proteins in biopharmaceuticals
- Sedimentation of suspensions
- Amorphous/crystalline content of tablets and APIs
- Fluorine content in tablets
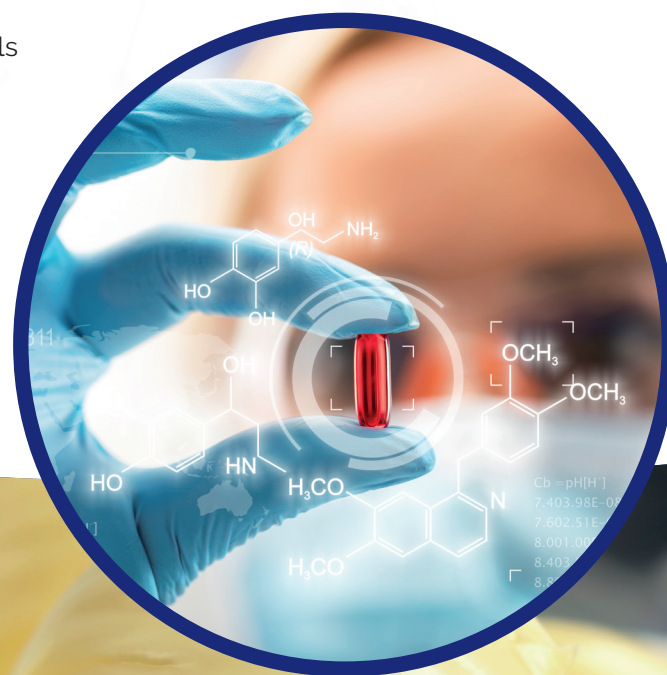
Chemical research:
- Kinetics, e.g. phase transition during reaction
- Pore size characterisation, e.g. catalysts
- Mass transport and diffusion
- Viscosity changes

Battery research:
- Slurry properties. Link viscosity, particulate distribution, and sedimentation to electrode coating efficiency

Materials research:
- Droplet size distribution, e.g. paint
- Porous media characterisation and fluid transport properties, e.g. concrete
- Moisture content
- Hydration and aging processes

MQC-R hardware

Magnetic field strength (operating frequency)	0.55 Tesla (23 MHz for ^{1}H)
Probe size diameter (sample volume)	10 mm (1 ml), 18 mm (7 ml), 26 mm (14 ml)
P90 (10 mm probe)	<3 µs
Data sampling rate	Dependent on filters, typically 16 MHz/16 bit
Data point capacity	>128 k
RF power	250 W 10% duty cycle
Pulsed field gradient (along probe bore)*	≥3.0 T/m
Liquid-controlled variable temperature probe (^{1}H only)*	10 mm or 18 mm, -5˚C to +70˚C (requires additional equipment)
PC	External Windows 11 PC and monitor is supplied with research systems. Integrated PC and monitor is supplied for QA/QC only systems, e.g. droplet size.

*Options

Research software

NMR ProLab is an exclusive, user-orientated software powered by Green Imaging.

Green Imaging

Package	Experiments Included	Standard / Option
MQC-R Base	• Free induction decay for T_2* • Inversion recovery and saturation recovery T_1 • CPMG and Hahn echo T_2 • Solid echo • FID-CPMG	Standard on all research systems
MQC-R Standard Gradient	• PFG spin echo and stimulated echo diffusion • 1D Profiles (Spin Echo, SPRITE and SE-SPI)[1]	Standard on all research systems with pulsed field gradient hardware
MQC-R 2D Relaxometry	• T_1-T_2 (Inversion and saturation recovery)[2] • T_2-T_2 exchange[2] • T_1-T_2* (Saturation recovery - FID)[2][3] • T_1-T_2*-T_2 (Inversion Recovery - FID-CPMG) [4]	Optional
MQC-R Advanced Gradient	• T_2-Diffusion (2D)[2] • 1D spatially resolved T_2 [5], T_1 and T_1-T_2	Optional, requires pulsed field gradient hardware

Industry focused software

Any Oxford Instruments TD-NMR QA/QC application software (e.g. oil, water, solid fat, fluorine and amorphous/crystalline content) can be installed alongside the research software. The MQC-R can also be solely used for QA/QC applications that only the MQC-R hardware supports, for example droplet size distribution (DSD) of emulsions. In these instances the MQC-R will be configured with Oxford Instruments TD-NMR QA/QC application software only, and the research software will be an optional upgrade.

Visit **nmr.oxinst.com/mqc-r**

[1] Patent: US9018950
[2] Patent: EP2437078 and US9874619
[3] Patents: US11486949
[4] Patents: US2021/0123874
[5] Patents: EP2310867

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