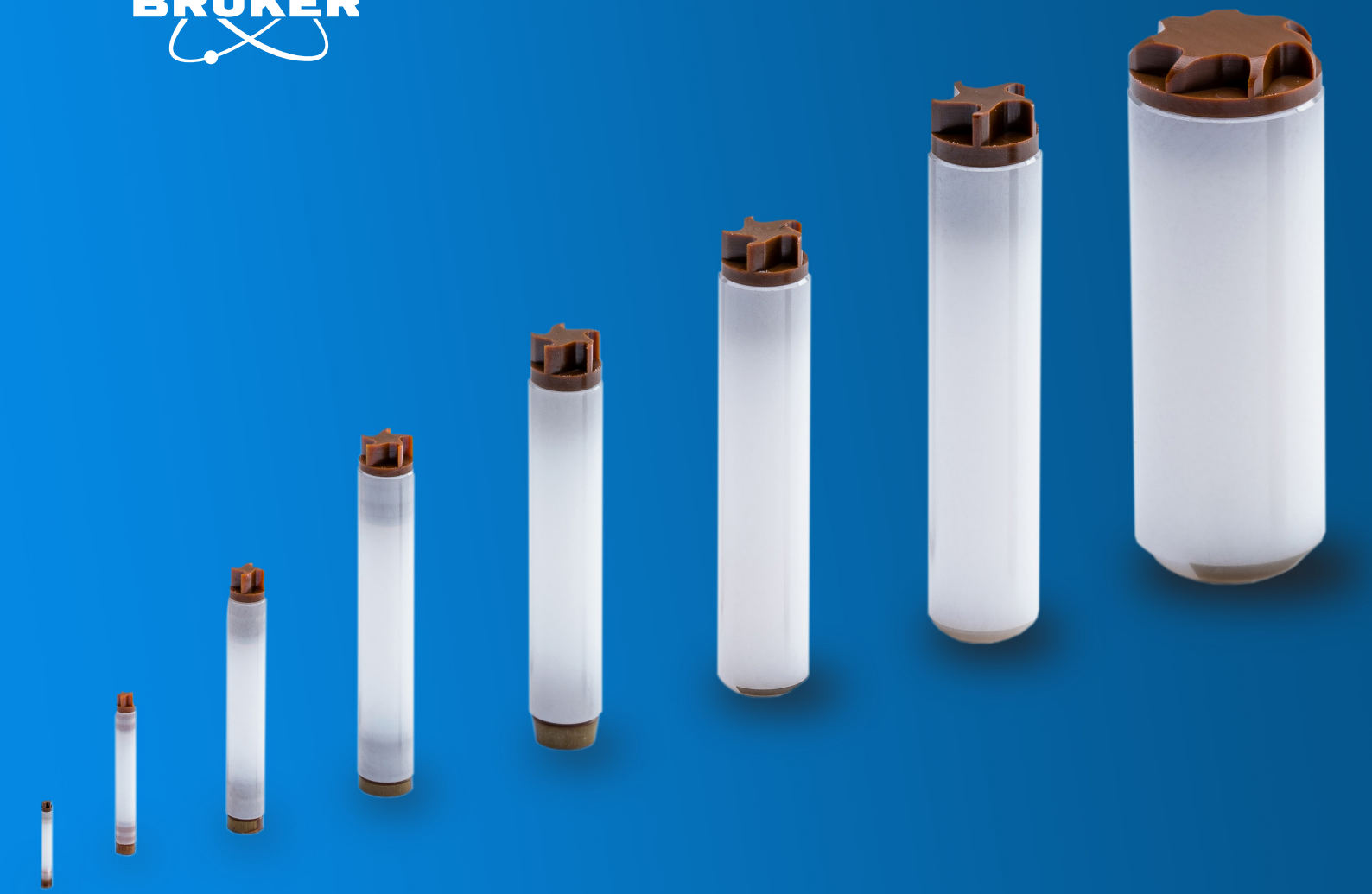


BRUKER LABSCAPE CONSUMABLES, FILLING TOOLS AND REFERENCE STANDARDS

Solid-State NMR

We‘ve got you covered

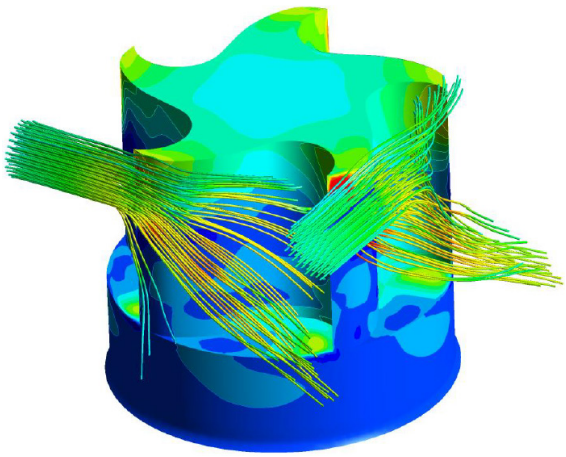
Innovation with Integrity

Why Bruker Solid-State NMR Consumables?

Bruker is delighted to present a comprehensive range of LabScape®-certified solid-state NMR consumables that are specifically designed to work seamlessly with our NMR instruments and enhance your solid-state NMR experiments. At Bruker, we take great pride in our commitment to delivering products of the highest quality, and our solid-state NMR consumables are no exception. Our consumables are meticulously engineered and manufactured to meet the rigorous demands of solid-state NMR experiments, ensuring exceptional performance and consistent results.

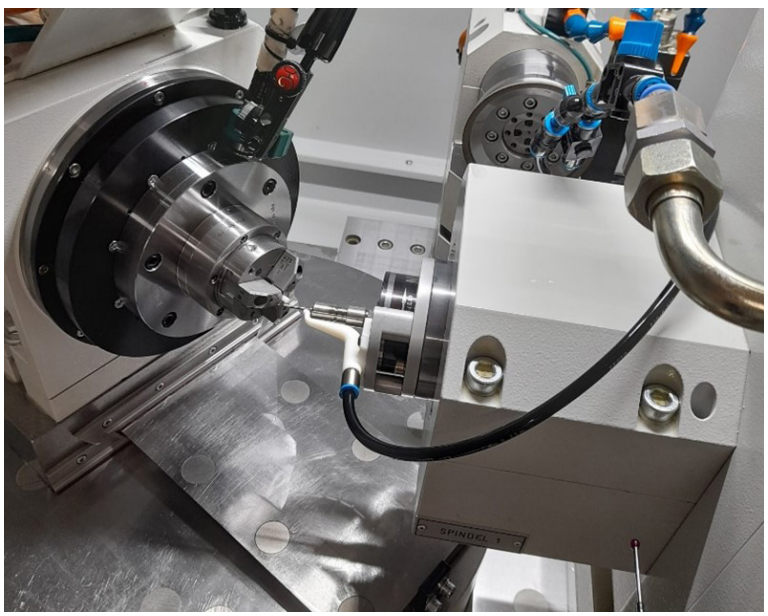
Most solid-state NMR experiments involve Magic Angle Spinning (MAS). Bruker's portfolio thus includes a **large selection of components such as rotors, caps, rotor filling tools or rotor test stands.**

At the heart of every great product lies a great design, and Bruker's cross-functional MAS systems team boasts decades of experience in this field. Bruker's MAS team comprises material scientists, process engineers, mechanical engineers, and physicists. This multidisciplinary approach ensures that every aspect of our consumables is scrutinized with meticulous attention to detail, resulting in **products of unrivaled quality**.



For instance, our MAS NMR rotors are developed using advanced techniques such as Finite Element Method (FEM) and Computational Fluid Dynamics (CFD). These simulations ensure that our rotors can withstand the extreme stresses experienced during fast MAS spinning, and that the drive and bearing designs are optimized for rotational stability, pneumatic efficiency, and high-speed performance. The resulting intricate mechanical design exemplifies our commitment to excellence.

For most solid-state consumables, Bruker controls the entire process, from design to manufacturing and quality control. This vertical integration allows us to maintain complete oversight and guarantees the superior quality of our products.

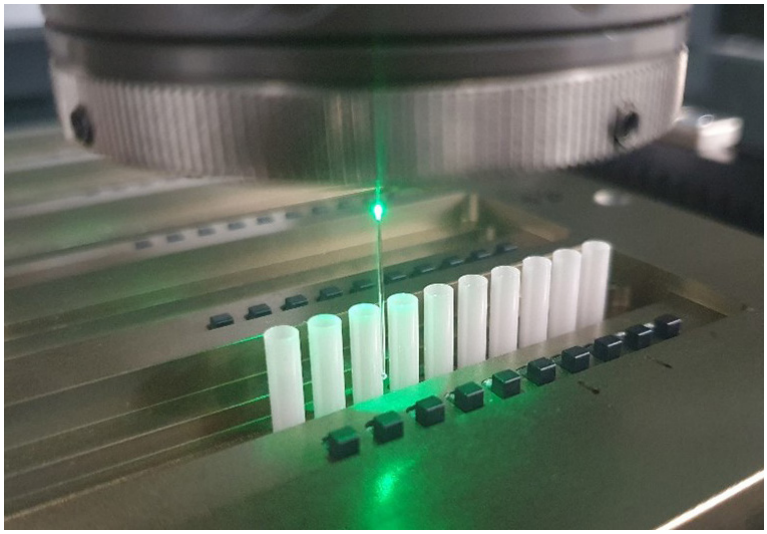


MAS NMR rotors are crafted from ceramic materials. To ensure optimal material properties, Bruker maintains **strict control over all manufacturing steps**, including the precision pressing and the sintering of the ceramic starting material, leaving no room for compromise in quality.

Meticulous attention is given to material composition and purity when sourcing starting materials, as any impurities can introduce unwanted background signals during NMR experiments. The mechanical machining process is executed using high-precision machines, ensuring sub-micrometer precision. Bruker takes the time needed to produce rotors with the impeccable surface quality which is required to enable reliable and stable transonic spinning at speeds that are close to the speed of sound of the fluid surrounding the rotor.

The caps for our rotors are milled using materials such as Kel-F or Vespel, known for their exceptional suitability for NMR applications. These materials pose significant challenges in machining, but our expertise and experience guarantee that the tight tolerance requirements are consistently met.

Quality control is a cornerstone of Bruker's manufacturing process, both during critical steps of production and on the final product. Stringent quality control is key to being able to provide the NMR community with reliable and highly performant NMR rotors, and to being able to ensure the required high quality in a consistent manner and for sizable production batches.

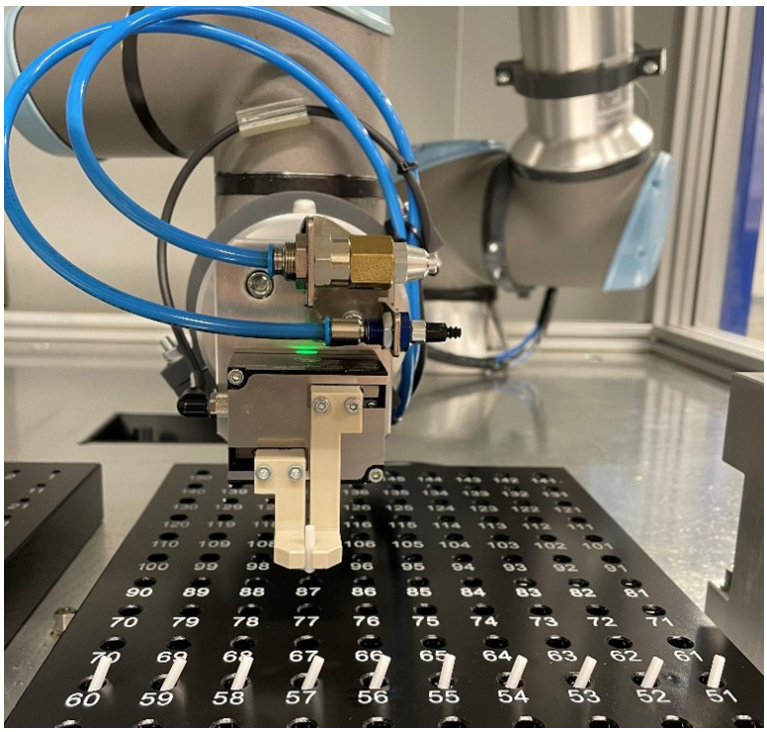


Every rotor undergoes thorough visual inspection, and all standard-diameter rotors are spin-tested to simulate centrifugal forces encountered during NMR experiments at the maximum MAS rate. Dimensional control is meticulously performed using optical means and supported by the use of a 3D fiber probe to verify dimensions with utmost precision.

To ensure convenience and efficiency, Bruker rotors are delivered in a specially designed workflow-optimized packaging. This packaging seamlessly integrates with Bruker's solid-state NMR toolsets, facilitating fast and efficient rotor handling.

Bruker's solid-state NMR consumables are complemented by a range of **tools** specifically designed to enhance your solid-state NMR workflow, e.g. for filling rotors or for spin-testing rotors after they have been filled. These tools are meticulously crafted to streamline your laboratory processes, improve efficiency, and ensure optimal performance.

Bruker also offers **NMR standard samples** to support your research and ensure the highest level of accuracy and calibration in your experiments. We understand the importance of reliable reference materials in NMR spectroscopy, and our standard samples are meticulously prepared to meet the stringent requirements of the scientific community. Our NMR standard samples are available in two forms: powdered substances and pre-filled rotors. The powdered substances are carefully selected and prepared with the utmost precision to ensure consistent composition and purity.



Bruker also offers **pre-filled rotors** with predefined compounds of known concentration and composition. These ready-to-use rotors provide a convenient and time-saving solution, eliminating the need for manual filling and reducing the potential for human error. With our pre-filled rotors, you can confidently perform quality control checks, verify instrument performance, and validate your experimental protocols.

When you choose Bruker's solid-state NMR consumables, you are choosing unparalleled quality, precision, and reliability. We are committed to pushing the boundaries of scientific exploration, and our consumables serve as the cornerstone for your success in solid-state NMR experiments.

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Consumables for CPMAS and HRMAS

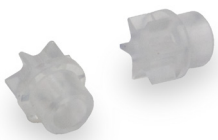
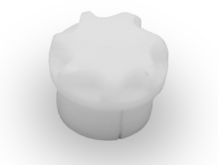
Bruker offers a wide range of rotors and caps for various applications. Rotors and caps for solid-state NMR applications are available for the full range of Bruker's MAS classes between 160 kHz and 7 kHz, corresponding to rotor diameters from 0.4 mm to 7 mm.

Maximum MAS Speed [kHz]	Rotor Diameter [mm]	Rotor Volume [µl] (Rounded)	Comments
160	0.4	0.12	Through-bore
111	0.7	0.6	Through-bore
67	1.3	3	Through-bore
42	1.9	13	Through-bore
35	2.5	14	Through-bore
24 [(1)]	3.2	47	Blind-bore
15	4	106	Blind-bore
7	7	360	Blind-bore

[(1)] With Kel-F caps, which are no longer available for sale but might still be in use in some labs, the maximum allowable spinning rate must be de-rated to 20 kHz.

Bruker's MAS rotors are typically made from zirconia (ZrO_2). This material has excellent mechanical properties and is thus ideally suited for the high mechanical loads that occur during very fast magic angle spinning. For a few selected applications, rotors made from silicon nitride (Si_3N_4) are best suited. As Si_3N_4 contains no oxygen, the material is used for NMR measurements where a ^{17}O background must be eliminated. Also, Si_3N_4 has favorable dielectric properties which makes it the material of choice for Bruker's MAS CryoProbe rotors. For other applications, Si_3N_4 rotors are available from Bruker on special request. For DNP NMR experiments, sapphire rotors are sometimes used.

Standard caps are available in three different materials. The temperature range of the measurement as well as the compound which is investigated in the NMR experiment must be taken into account when selecting the cap material.

Cap Material		Temperature	Notes
Kel-F (Chlorofluoropolymer) ^1H-free		From about -10 °C to +50 °C	Shrinks when cold Softens and deforms when hot Easy to pull out Due to spinning speed limitations for 3.2 mm rotors, these caps are only available for 7 mm and 4 mm.
Vespel (Polyimide) ^{19}F-free		From about -30 °C to +80 °C	Easy to pull out
ZrO_2 (Ceramic) ^1H- and ^{19}F-free		Complete temperature range	Mechanically durable

Rotors with a smaller diameter, specifically from 0.4 mm to 2.5 mm, are open on both ends (tubes). This is helpful for the filling of the rotors with the sample as well as for the cleaning of the rotor.

For these "through-bore" rotors, two types of caps are required: the bottom cap and the top cap (called the "drive cap").



2.5 mm through-bore rotor with drive and bottom Vespel caps

The rotors with a larger diameter, specifically from 3.2 mm to 7 mm, are open on one side only ("blind-bore"). These rotors only need a top ("drive") cap.



7 mm blind-bore rotor with drive cap

Rotor Kits and Spare Caps

For all rotor diameters, Bruker offers convenient kits containing a rotor and a set of suitable caps, providing the user with everything needed for rotor preparation. The MAS rotors are made for multiple use. In addition to these kits, individual spare caps are available, as the rotors can typically be used for a longer time than the caps. The caps for 0.4 mm and 0.7 mm rotors are only designed for single use, for instance. For 1.3 mm and 1.9 mm, Bruker offers "Tight-Fit" rotor kits, where rotors and caps are hand-matched to provide best possible tolerance matching. This is especially useful for low temperature applications such as LTMAS and DNP.



Through-bore rotor kit
(0.7 mm rotor kit **H153268**)



Through-bore rotor kit
(1.9 mm rotor kit **H123832**)



Blind-bore rotor kit
(3.2 mm rotor kit **HZ16916**)

Plugs and Inserts for Sealing and Volume Reduction

For some applications, especially when liquid samples need to be filled into MAS rotors, special sealing plugs are used. These plugs are available in sets for 1.3 mm and 1.9 mm rotors. Each set contains 50 silicone rubber plugs and 50 fluoroelastomer (FKM) plugs, and includes the tools required to handle the plugs.





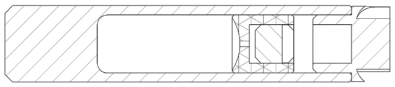
Sealing plug kit (1.9 mm **H173614**, 1.3 mm **H173615**)

4 mm Rotor Geometries

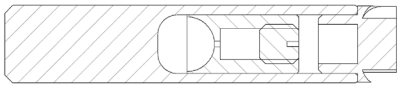
Bruker offers 4 mm rotors with three different geometries, as shown in the schematics below. The first such rotor geometry, with a sample volume of 80 µl, is typically used for CPMAS applications.



80 µl 4 mm rotor (CPMAS)
with cap



50 µl 4 mm rotor (HRMAS)
with insert and cap



12 µl 4 mm rotor (HRMAS)
with insert and cap

The 4 mm 80 µl rotors can also be used for HRMAS experiments. In that case, disposable inserts are typically used. These inserts, with a sample volume of 25 µl, are ideally suited for samples which are disposed after an NMR experiment and simplify the cleaning of the NMR rotor. The sample material is first placed into the insert, which is then slid into the NMR rotor.

For HRMAS applications, two additional 4 mm rotor geometries are available which have been designed to confine the solvent and to optimize the shimmability. These rotors are available in two versions, one with a 50 µl cylindrical sample volume for highest sensitivity, and one with a 12 µl spherical sample volume for highest B1 homogeneity and minimal temperature gradients in the sample. With the help of the special inserts and a dedicated positioning tool, the sample volume can be exactly controlled and positioned at the center of the NMR coil. Ventilation holes in the inserts facilitate the preparation of the rotor, and sealing screws prevent the spillage of the sample and secure the insert.

Ordering Information

Rotor Kits and Caps for 7 mm Rotors

Material Number	Product Type	Description
H14357	Rotor kit	1x zirconia blind-bore rotor 3x Kel-F drive caps
K1921	Rotor kit	1x zirconia blind-bore rotor 2x Kel-F drive caps 1x Vespel drive cap
H14358	Rotor kit	1x zirconia blind-bore rotor 1x Kel-F drive caps 1x zirconia drive cap
H6244	Caps	1x Kel-F drive cap
H153899	Caps	1x Vespel drive cap
HZ2717	Caps	1x zirconia drive cap



7 mm rotor kit (**H14357**)

Rotor Kits, Caps, Plugs and Inserts for 4 mm Rotors

Rotors with 80 µl sample volume

Material Number	Product Type	Description
H14355	Rotor kit	1x zirconia blind-bore rotor 3x Kel-F drive caps
K1910	Rotor kit	1x zirconia blind-bore rotor 2x Kel-F drive caps 1x Vespel drive cap
H14356	Rotor kit	1x zirconia blind-bore rotor 1x Kel-F drive cap 1x zirconia drive cap
H6304	Caps	1x Kel-F drive cap
HZ12360	Caps	1x Vespel drive cap
HZ05951	Caps	1x zirconia drive cap
B4493	Rotor kit	10x disposable insert incl. Plug 1x tool set
34112029	Disposable inserts	50x disposable inserts, without tools



4 mm rotor kit (**H14356**)

Rotors with 50 µl sample volume

Material Number	Product Type	Description
H191765	HRMAS rotor kit	1x zirconia blind-bore rotor (50 µl) 3x Kel-F drive caps 1x 50 µl volume reduction insert 1x sealing thread
H191763	Insert kit	5x 50 µl volume reduction insert 5x sealing thread
B2950	Tools	Tool set for inserts

Rotors with 12 µl sample volume

Material Number	Product Type	Description
H191762	HRMAS rotor kit	1x zirconia blind-bore rotor (12 µl) 3x Kel-F drive caps 1x 12 µl volume reduction insert 1x sealing thread
H191764	Insert kit	5x 12 µl volume reduction insert 5x sealing thread
B2950	Tools	Tool set for inserts



Tool set for inserts (**B2950**)

Rotor Kits, Caps and Inserts for 3.2 mm Rotors

Material Number	Product Type	Description
HZ16916	Rotor kit	1x zirconia blind-bore rotor 3x Vespel drive caps
H162807	Caps	1x zirconia drive cap
HZ16253	Caps	1x Vespel drive cap
34112028	Insert	Disposable PTFE inserts 3.2 mm



3.2 mm rotor kit (**HZ16916**)

Rotor Kits and Caps for 2.5 mm Rotors

Material Number	Product Type	Description
HZ15196	Rotor kit	1x zirconia through-bore rotor 2x Vespel drive caps 2x Vespel bottom caps
H193194	Caps	2x Vespel drive caps 2x Vespel bottom caps



2.5 mm rotor kit (**HZ15196**)

Rotor Kits, Caps and Plugs for 1.9 mm Rotors

Material Number	Product Type	Description
H123832	Rotor kit	1x zirconia through-bore rotor 2x Vespel drive caps 2x Vespel bottom caps
H123832-01	Rotor kit	"Tight-fit" rotor kit: 1x zirconia through-bore rotor 4x Vespel drive caps 4x Vespel bottom caps
H183243	Caps	2x Vespel drive caps 2x Vespel bottom caps
H173614	Plugs	Sealing plug kit



1.9 mm rotor kit (**H123832**)

Rotor Kits, Caps and Plugs for 1.3 mm Rotors

Material Number	Product Type	Description
HZ14752	Rotor kit	1x zirconia through-bore rotor 2x Vespel drive caps 2x Vespel bottom caps
HZ14752-01	Rotor kit	"Tight-fit" rotor kit: 1x zirconia through-bore rotor 4x Vespel drive caps 4x Vespel bottom caps
H183242	Caps	2x Vespel drive caps 2x Vespel bottom caps
H173615	Plugs	Sealing plug kit



1.3 mm rotor kit (**HZ14752**)

Rotor Kits and Caps for 0.7 mm Rotors

Material Number	Product Type	Description
H153268	Rotor kit	1x zirconia through-bore rotor 4x Vespel drive caps 4x Vespel bottom caps
H162624	Caps	2x Vespel drive caps 2x Vespel bottom caps



0.7 mm rotor kit (**H153268**)

Rotor Kits and Caps for 0.4 mm Rotors

Material Number	Product Type	Description
H194986	Rotor kit	1x zirconia through-bore rotor 4x Vespel drive caps 4x Vespel bottom caps
34100970	Caps	2x Vespel drive caps 2x Vespel bottom caps

Filling Tools for CPMAS and HRMAS

Each MAS rotor size has its own rotor filling tools. MAS tools have been designed to aid solid-state NMR sample preparation. Unbalanced rotors due to improperly positioned caps or a non-homogenous packed sample can cause spinning instability resulting in a rotor crash and probe damage.

The described toolsets are available for all rotor diameters ≥ 1.3 mm. For 1.3 mm, 0.7 mm and 0.4 mm rotors, Bruker offers specially designed work-flow optimized toolsets to support handling of these tiny parts alongside a special preparation video describing the whole procedure. The toolsets for the small diameters are also color coded to make it easier to identify the tools for the top and bottom caps.

For more details, please watch our sample preparation video (rotor diameter ≥ 1.3 mm):

https://youtu.be/VE-raM5o_Yc

Filling Tools for 1.9 mm Rotors (7 mm, 4 mm, 3.2 mm, 2.5 mm and 1.3 mm look similar)



Cap removal: removes cap without damage (**HZ16858**)



Filling tool: loads sample into rotor barrel (**HZ16845**)



Packer: compresses sample inside rotor (**HZ16850**)

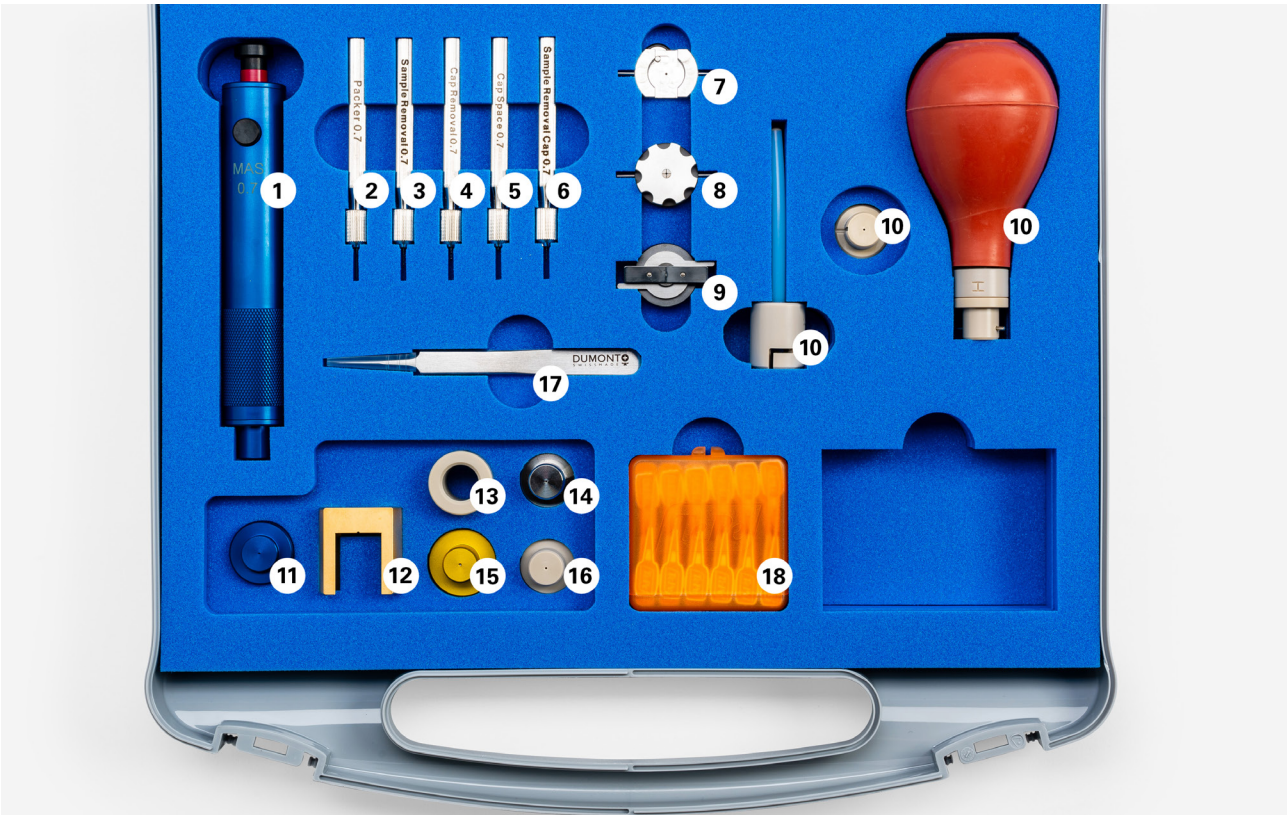


Cap set tool: correctly positions rotor cap (**HZ16855**)



Rotor marker pen: enables correct and precise spin rate detection (**88817**)

Work-Flow Optimized Filling and Handling Tools for Rotors ≤ 1.3 mm



Work-flow optimized filling and handling tools for 0.7 mm rotors (set for 1.3 mm looks similar)

1. **Grabbing tool:** safely grabs and moves the rotor and the caps
2. **Sample packer:** compresses the sample substance in the rotor
3. **Sample removal:** removes sample substance and cleans an already filled rotor
4. **Cap removal:** removes caps
5. **Cap space check tool:** checks if there is enough space to fit the top cap into the rotor
6. **Sample removal:** removes excess sample substance
7. **Rotor clamp:** holds the rotor
8. **Collet:** holds the rotor for the drive and bottom cap removal process
9. **Rotor cap removal:** removes a cap to open an already closed rotor
10. **Pipette & pipette nozzle:** helps to place the rotors into the probe and remove them from the probe
11. **Bottom cap holder:** holds the bottom caps
12. **Main guidance tool:** guides the various parts during the sample preparation
13. **Top cap guidance tool:** helps to correctly position the top cap into the top cap holder
14. **Support for the cleaning tool:** helps to correctly guide the sample removal tool
15. **Top cap holder:** holds the top cap for accurate positioning into the rotor
16. **Filling funnel:** helps to fill the sample into the rotor
17. **Tweezers:** emergency handling, if needed
18. **Cleaning Tools:** removes dust and particles

For more details please watch our sample preparation video (rotor diameter = 0.7 mm) on YouTube:

https://youtu.be/GnTpAyQ8GzA

Ordering Information

Material Number	Description
H194830	0.4 mm rotor filling tool set
H149435	0.7 mm rotor filling tool set
H158569	1.3 mm rotor filling tool set

Ordering Information

Filling Tools for 7 mm Rotors

Material Number	Product Type
HZ05755	Cap removal tool
HZ3328	Filling tool
H148514	Packer
H148487	Cap set tool
88817	Marker pen

Filling Tools for 4 mm Rotors

Material Number	Product Type
HZ05754	Cap removal tool
HZ3329	Filling tool
H148513	Packer
H148486	Cap set tool
88817	Marker pen

Filling Tools for 3.2 mm Rotors

Material Number	Product Type
HZ16913	Cap removal tool
HZ07608	Filling tool
HZ16911	Packer
HZ16621	Cap set tool
88817	Marker pen

Filling Tools for 2.5 mm Rotors

Material Number	Product Type
H13836	Cap removal tool
HZ15199	Filling tool
HZ15198	Packer
HZ16624	Cap set tool
88817	Marker pen

Filling Tools for 1.9 mm Rotors

Material Number	Product Type
HZ16858	Cap removal tool
HZ16845	Filling tool
HZ16850	Packer
HZ16855	Cap set tool
88817	Marker pen

Filling Tools for 1.3 mm Rotors

Material Number	Product Type
HZ14706	Cap removal tool
HZ14714	Filling tool
HZ14716	Packer
HZ14744	Cap set tool
88817	Marker pen

1.3 mm Work-Flow Optimized Filling Tools

Material Number	Description
H158569	Rotor filling tool set
H158312	Packer (subject to wear)
H158310	Sample removal (subject to wear)
H158311	Sample removal cap (subject to wear)
H158309	Cap space (subject to wear)
1841827	Grabbing tool O-ring (subject to wear)

0.7 mm Work-Flow Optimized Filling Tools

Material Number	Description
H149435	Rotor filling tool set
H153427	Packer (subject to wear)
H153428	Sample removal (subject to wear)
H153429	Sample removal cap (subject to wear)
H153878	Cap space (subject to wear)
1841827	Grabbing tool O-ring (subject to wear)

0.4 mm Work-Flow Optimized Filling Tools

Material Number	Description
H194830	Rotor filling tool set
H195278	Cap set tool
H195310	Collect
H195329	Cap removal tool
H195332	Filling funnel

Special Aids for Small Rotor Diameters

To facilitate handling of rotors and caps with very small diameters, the use of a dedicated microscope is recommended. For 0.4 mm and 0.7 mm, a tool kit is available which can be used to fill 0.4 mm and 0.7 mm rotors with a sample by means of a centrifuge.



Microscope (**AH1232**)



Centrifuge filling tools exist for 0.7 mm rotors **(H171133)** and for 0.4 mm rotors **(H195068)**.

MAS Shuttles for Automation in Solid-State NMR

Bruker's MAS Shuttles transport MAS rotors to and from the sample volume inside the NMR probe. The shuttles are available for 3.2 mm and 4 mm rotors. They are compatible with Bruker's MAS iProbes. In combination with Bruker's SampleCase, they facilitate automated operation, remote operation and help to increase throughput.

MAS Shuttles

Material Number	Product Type	Description
Z192376	MAS shuttle	For 3.2 mm rotors
Z175710	MAS shuttle	For 4 mm rotors
Z193045	MAS shuttle	For 1.9 mm rotors
Z193052	MAS shuttle	For 1.3 mm rotors

For more details, watch our video on how Bruker's MAS Shuttle enables fully automated solid-state NMR:

https://youtu.be/uPOlZdNPsqY



4 mm (**Z175710**) and 3.2 mm (**Z192376**) MAS shuttles

Rotor Test Stands for CPMAS

Modular rotor test stands are used in conjunction with Bruker's MAS probes to ensure that rotors have been properly packed with the sample substance and spin stably and reliably, before inserting rotors into a MAS probe.

The rotor test stands consist of a base station and can be equipped with different modules for different rotor diameters.

A MAS III unit is required to supply the bearing and drive gas and measure and control the spinning rate to operate the rotor test stand.

Rotor Test Stands

Material Number	Description
AH1229-00	Rotor test stand base station
AH1229M-04	Module for 0.4 mm rotors
AH1229M-07	Module for 0.7 mm rotors
AH1229M-13	Module for 1.3 mm rotors
AH1229M-19	Module for 1.9 mm rotors
AH1229M-32	Module for 3.2 mm rotors
AH1229M-40	Module for 4 mm rotors
AH1229M-70	Module for 7 mm rotors



Rotor test stand base station (**AH1229-00**) with module for 1.3 mm rotors (**AH1229M-13**)

Consumables and Filling Tools for MAS CryoProbes

Bruker's MAS CryoProbes make use of dedicated 3.2 mm rotors. For MAS CryoProbes, silicon nitride rotors are used for all standard applications due to their favorable dielectric properties. If background issues arise, zirconia rotors are available on special request.

3.2 mm Rotors for MAS CryoProbes

Material Number	Product Type	Description
Z163919	Rotor kit	1x Si_3N_4 rotor 3x Vespel cap
Z163918*	Rotor kit	1x zirconia rotor 3x Vespel cap
Z174268	Caps	1x Vespel cap

**Before placing your order, please reach out to your sales contact to confirm compatibility.*

For the rotors listed above, spacers with different thicknesses are available to center-pack samples.

Spacers for MAS CryoProbes

Material Number	Description
Z171725	Top spacer, 0.5 mm, Teflon
Z173781	Top spacer, 1.0 mm, Teflon
Z173782	Top spacer, 2.0 mm, Teflon
Z173783	Top spacer, 3.0 mm, Teflon
Z173784	Top spacer, 4.0 mm, Teflon
Z173785	Top spacer, 5.0 mm, Teflon
Z173786	Top spacer, 6.0 mm, Teflon



Top spacer, Teflon

Material Number	Description
Z171726	Bottom spacer, 1.0 mm, Teflon
Z171727	Bottom spacer, 2.0 mm, Teflon
Z171728	Bottom spacer, 3.0 mm, Teflon
Z171729	Bottom spacer, 4.0 mm, Teflon
Z171730	Bottom spacer, 5.0 mm, Teflon
Z171731	Bottom spacer, 6.0 mm, Teflon



Bottom spacer, Teflon

Packing Tools for MAS CryoProbes

Material Number	Product Type
Z194854	Rotor filling tool set for MAS cryoprobes: 1x cap positioning tool 1x filling funnel 1x packing tool 1x sample extraction drill 2x rotor lock 1x tweezers 1x guiding tool for packing tool 1x cap removal tool 1x spacer removal tool for threaded spacers 1x spacer removal tool for non-threaded spacers 1x holder for spacer removal tool 1x spatula 1x white marker pen 1x black marker pen



Rotor filling tool set for MAS CryoProbes (**Z194854**)

The tools below can be used to transfer sample material from different containers into a 3.2 mm CryoProbe rotor when using a centrifuge.

Centrifuge Tools for MAS CryoProbes

Material Number	Description
Z193500	Centrifuge tool kit: 1x funnel 7.7 mm ID (compatible with 0.5 ml Eppendorf) 1x funnel 10.6 mm ID (compatible with 1.5 ml Eppendorf) 1x funnel 11 mm ID 1x funnel for emptying rotor 1x holder for Eppendorf 0.5 ml (for filling) 1x holder for Eppendorf 0.5 ml (for emptying) 1x cutting tool



Centrifuge tool kit (**Z193500**)

Dedicated tools are available to mark rotors for MAS CryoProbes to ensure reliable spin-rate detection.

Marking Tools for MAS CryoProbes

Material Number	Description
Z193473	White marking kit
1902338	Marker pen white
88817	Marker pen black



White marking kit (**Z193473**)

Consumables and Sample Preparation Kits for Solid-State DNP and LTMAS Probes

Solid-state Dynamic Nuclear Polarization (DNP) experiments are performed at low temperatures and require that microwaves can reach the sample substance with a minimum of attenuation. For 3.2 mm rotors which have a comparatively thick wall, it is thus recommended to use special sapphire rotors.

Sapphire Rotor Kits and Caps for DNP

Material Number	Product Type	Description
H13861	Rotor kit	1x 3.2 mm DNP sapphire rotor 2x DNP zirconia drive cap 1x DNP Vespel drive cap
HZ14471	Rotor	1x 3.2 mm DNP sapphire rotor
HZ12372	Caps	1x DNP zirconia drive cap

For 1.3 mm and 1.9 mm diameters, rotors made from zirconia can be used, but for DNP and for LTMAS applications, these should be selected as "tight-fit" variants. These are specially prepared rotor / cap pairs that maintain sample sealing and integrity on spinning in the ~ 95 K low temperature conditions of DNP and LTMAS.

"Tight-Fit" DNP Rotor Kits

Material Number	Product Type	Description
H123832-01	Rotor kit	1.9 mm DNP rotor kit: 1x DNP zirconia through-bore rotor 4x DNP Vespel drive caps 4x DNP bottom Vespel caps
HZ14752-01	Rotor kit	1.3 mm DNP rotor kit: 1x DNP zirconia through-bore rotor 4x DNP Vespel DNP caps 4x DNP bottom Vespel caps



DNP Zirconia drive cap (**HZ12372**)



DNP rotor kit (**HZ14752-01**)

For 3.2 mm DNP rotors, a dedicated sample preparation kit is available from Bruker. In addition to the complete kit, individual components can be purchased, too.

DNP Sample Preparation Kit for sapphire rotors

Material Number	Description
H160769	Complete sample preparation rotor for sapphire rotors



3.2 mm DNP sample preparation kit (**H160769**)

Individual Components

Material Number	Description
H160695	Long PTFE spacer for powder samples
H160697	Short PTFE spacer for powder samples
68449	Screw for inserting/removing PTFE spacers
H160698	Rotor funnel for centrifugal packing
H160699	Removal tool for soft silicone plugs
H160700	Depth gauge for inserting silicone plugs
HZ07608	Filling tool for DNP powder samples
HZ07607	Rotor packer for DNP powder samples
H176385	10x soft silicone plugs

DNP Sample Preparation Kit for zirconia rotors

Material Number	Description
34106157	Complete sample preparation kit for zirconia rotors

Individual Components

Material Number	Description
34106137	Long PTFE spacer for powder samples
34106096	Short PTFE spacer for powder samples
68449	Screw for inserting/removing PTFE spacers
H160698	Rotor funnel for centrifugal packing
3410643	Removal tool for soft silicone plugs
H1606140	Depth gauge for inserting silicone plugs
HZ07608	Filling tool for DNP powder samples
HZ07607	Rotor packer for DNP powder samples
34106152	10x soft silicone plugs

The filling tools and soft plugs described in the chapter "Filling Tools for CPMAS and HRMAS" can also be used for 1.3 mm and 1.9 mm DNP rotors. For 0.7 mm and 1.3 mm rotors, the work-flow optimized filling tools are highly recommended.

Work-Flow Optimized Filling Tools

Material Number	Product Type	Description
H158569	Tools	Filling tool set for 1.3 mm rotors
H149435	Tools	Filling tool set for 0.7 mm rotors

Consumables for Battery Research Probes

In collaboration with ePROBE, Bruker offers solid-state NMR systems which are geared towards in situ research on energy storage materials such as batteries and supercapacitors. A range of in situ NMR consumables, e.g. cells, are available for these systems.

Battery NMR Consumables

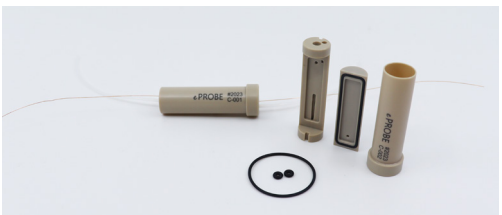
Material Number	Product Type	Description
AH0955_OD08	In-situ battery cell set	10x plastic cell capsules, 8 mm OD, L = 26 mm, no flow option 1x assembly and disassembly tool Accessories (e.g. O-rings, wire, mesh, spacers and sealing material)
AH0955_OD11	In-situ battery cell set	10x plastic cell capsules, 11 mm OD, L = 26 mm, no flow option 1x assembly and disassembly tool Accessories (e.g. O-rings, wire, mesh, spacers and sealing material)
AH0955_OD11_WF	In-situ battery cell set	10x plastic cell capsules, 11 mm OD, L = 26 mm, with flow option, including tubing 1x assembly and disassembly tool Accessories (e.g. O-rings, wire, mesh, spacers and sealing material)
AH0955_OD11L_WF	In-situ battery cell set	10x plastic cell capsules, 11 mm OD, L = 40 mm, with flow option, including tubing 1x assembly and disassembly tool Accessories (e.g. O-rings, wire, mesh, spacers and sealing material)
AH0955_OD15	In-situ battery cell set	10x plastic cell capsules, 15 mm OD, L = 26 mm, no flow option 1x assembly and disassembly tool Accessories (e.g. O-rings, wire, mesh, spacers and sealing material)



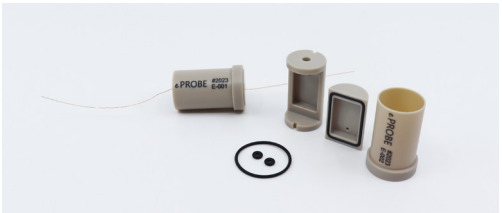
In-situ battery cell set, consisting of plastic cell capsules, an assembly and disassembly tool and various accessories



OD 8 mm / L 26 mm battery cell,
no flow option



OD 11 mm / L 40 mm battery cell,
with flow option



OD 15 mm / L 26 mm battery cell,
no flow option

Consumables for MASCAT Probes

MASCAT probes are used for NMR experiments to elucidate catalyst behavior under reactive gas exposure and variable temperatures of up to 400 °C. For such experiments, special 7 mm MAS rotors are used. MASCAT rotors have a hole in the drive cap to facilitate gas flow into the rotor to the sample substance.

MASCAT Consumables

Material Number	Product Type	Description
H12032	Rotor kit	1x zirconia blind-bore rotor 1x zirconia MASCAT cap

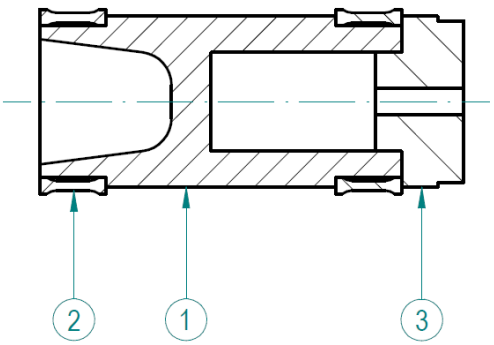


MASCAT rotor kit (**H12032**)

Consumables for LaserMAS Probes

Bruker's CPMAS Laser probes enable CPMAS NMR experiments at sample temperatures of up to 700 °C.

For such experiments, the sample substance is placed in a special container which can be heated with a laser during the NMR experiment. This ceramic container is then inserted into a special, heat-resistant 7 mm rotor. To ensure small temperature gradients, the ceramic container is thermally separated from the rotor by Macor spacers.



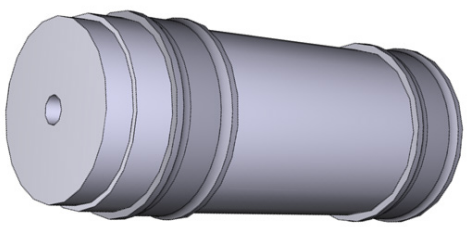
Sample container (1), Macor spacers (2) and cap (3)

LaserMAS Consumables

Material Number	Product Type	Description
AH3077_70ZA	Rotor kit	7 mm LaserMAS rotor kit consisting of: 1x ceramic sample container 1x sample container cap 1x 7 mm LaserMAS rotor 1x drive cap 2x Macor spacer







Sample container, Macor spacers and cap (rendering)

 Order your consumables at the Bruker Store

Standard Samples for Solid-State NMR and HRMAS

Sample substances for standardized NMR tests can be procured from Bruker, e.g. for adjusting the magic angle, for shimming, for performing sensitivity tests or for calibrating pulses. These substances are shipped in glass vials and can be packed into rotors by the NMR user.

NMR Standard Samples

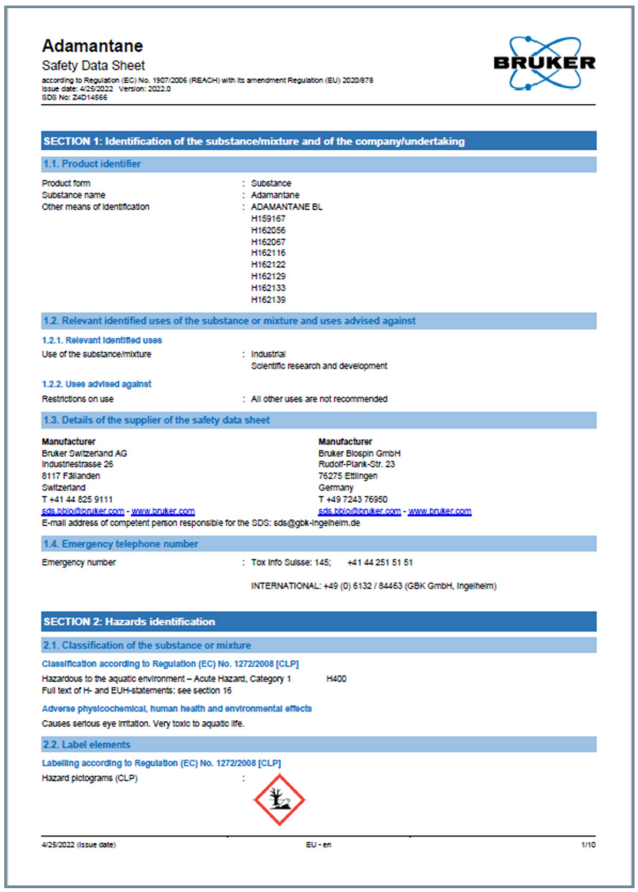
Material Number	Product Type	Description
AH3080	Solid-state NMR samples	1 g glycine / $C_2H_5NO_2$ (sensitivity test sample) 1 g adamantane / $C_{10}H_{16}$ (lineshape test sample) 1 g KBr (sample for magic angle setting) 1 g $C_2H_4O_2F_3N$ (^{19}F pulse calibration sample) 1 g H_6NO_4P (^{31}P pulse calibration sample)
H161002	Solid-state NMR samples	30 mg glycine-2-^{13}C, ^{15}N sample
Z183550	HRMAS NMR samples	HRMAS installation sample kit: 1 g KBr (sample for magic angle setting) 600 µl 3 % chloroform in acetone-D6 (lineshape test sample) 600 µl 2 mm sucrose, 0.5 mm DSS, 2 mm NaN_3 in 90% H_2O / 10% D_2O (water suppression test sample) 600 µl 40% dioxane in benzene-D6 (^{13}C sensitivity test sample) 600 µl 0.1% ethylbenzene (EB) in chloroform-D (^{1}H sensitivity test sample) 600 µl urea-^{15}N and 100 mm methanol-^{13}C in dimethylsulfoxide-D6 (pulse calibration sample) 600 µl 0.0485 M triphenyl phosphate in acetone-D6 (^{31}P sensitivity and pulse calibration sample)
Z183528	HRMAS NMR samples	HRMAS applications sample kit: 1 g KBr (sample for magic angle setting) 600 µl 3 % chloroform in acetone-D6 (lineshape test sample) 600 µl 2 mm sucrose, 0.5 mm DSS, 2 mm NaN_3 in 90% H_2O / 10% D_2O (water suppression test sample) 600 µl 40% dioxane in benzene-D6 (^{13}C sensitivity test sample) 600 µl 0.1% ethylbenzene (EB) in chloroform-D (^{1}H sensitivity test sample) 600 µl urea-^{15}N and 100 mm methanol-^{13}C in dimethylsulfoxide-D6 (pulse calibration sample) 600 µl 0.0485 M triphenyl phosphate in acetone-D6 (^{31}P sensitivity and pulse calibration sample) 600 µl 0.05% trifluorotoluene in chloroform-D (^{19}F sensitivity and pulse calibration sample) 600 µl 99.8 % methanol-D4 (NMR thermometer sample MeOD) 600 µl 4% methanol in methanol-d4 (NMR thermometer sample MeOH) 600 µl 0.1% methanol-^{13}C + 0.1 mg/ml $GdCl_3$ in 98.9% D_2O + 1% H_2O (gradient recovery test sample) 600 µl 25 mm cyclosporine-A in benzene-D6 (2D setup sample)

For NMR users who value convenience and prefer to rely on high-quality reference standards, Bruker offers rotors which have been pre-packed with the most important sample substances. Pre-packed 4.0 mm rotors are also available in a GxP version for use in regulated environements, e.g. in the pharmaceutical or biopharmaceutical industry.

Pre-Packed NMR Rotors

Material Number	Product Type	Description
AH3083_04V	NMR sample	Set of pre-packaed 0.4 mm rotors: 1x 0.4 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 0.4 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 0.4 mm prefilled rotor for magic angle setting (KBr) 1x 0.4 mm prefilled rotor for 19F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 0.4 mm prefilled rotor for 31P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 0.4 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, $_{15}N$)
AH3083_07V	NMR sample	Set of pre-packed 0.7 mm rotors: 1x 0.7 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 0.7 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 0.7 mm prefilled rotor for magic angle setting (KBr) 1x 0.7 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 0.7 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 0.7 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3083_13V	NMR sample	Set of pre-packed 1.3 mm rotors: 1x 1.3 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 1.3 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 1.3 mm prefilled rotor for magic angle setting (KBr) 1x 1.3 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 1.3 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 1.3 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3083_19V	NMR sample	Set of pre-packed 1.9 mm rotors: 1x 1.9 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 1.9 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 1.9 mm prefilled rotor for magic angle setting (KBr) 1x 1.9 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 1.9 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 1.9 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3083_25V	NMR sample	Set of pre-packed 2.5 mm rotors: 1x 2.5 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 2.5 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 2.5 mm prefilled rotor for magic angle setting (KBr) 1x 2.5 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 2.5 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 2.5 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3083_32VA	NMR sample	Set of pre-packed 3.2 mm rotors: 1x 3.2 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 3.2 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 3.2 mm prefilled rotor for magic angle setting (KBr) 1x 3.2 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 3.2 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 3.2 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3083_40VK	NMR sample	Set of pre-packed 4 mm rotors: 1x 4 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 4 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 4 mm prefilled rotor for magic angle setting (KBr) 1x 4 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 4 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 4 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3083_70VK	NMR sample	Set of pre-packed 7 mm rotors: 1x 7 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 7 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 7 mm prefilled rotor for magic angle setting (KBr) 1x 7 mm prefilled rotor for ^{19}F calibration (ammonium trifluoroacetate / $C_2H_4O_2F_3N$) 1x 7 mm prefilled rotor for ^{31}P calibration (ammonium dihydrogenphosphate / H_6NO_4P) 1x 7 mm prefilled rotor for double-CP setup (labelled glycine-2-^{13}C, ^{15}N)
AH3080_40G	NMR sample for GXP	Set of pre-packed 4 mm rotors for GxP: 1x 4 mm prefilled rotor for sensitivity test (glycine / $C_2H_5NO_2$) 1x 4 mm prefilled rotor for lineshape test (adamantane / $C_{10}H_{16}$) 1x 4 mm prefilled rotor for magic angle setting (KBr)

Documentation such as safety data sheets for the sample substances and dedicated Bruker certificates for pre-packed NMR rotors is available for Bruker's GXP standard samples.



Adamantane
Safety Data Sheet

according to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2020/878
Issue date: 4/26/2022 Version: 2022.0
SDS No: Z4D14566

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Substance
Substance name : Adamantane
Other means of identification : ADAMANTANE BL
H159167
H162056
H162067
H162116
H162122
H162129
H162133
H162139

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Use of the substance/mixture : Industrial
Scientific research and development

1.2.2. Uses advised against

Restrictions on use : All other uses are not recommended

1.3. Details of the supplier of the safety data sheet

Manufacturer
Bruker Switzerland AG
Industriestrasse 26
8117 Fällanden
Switzerland
T +41 44 825 9111
sds.bsg@bruker.com - www.bruker.com

Manufacturer
Bruker Biospin GmbH
Rudolf-Plank-Str. 23
76275 Ettlingen
Germany
T +49 7243 76950
sds.bio@bruker.com - www.bruker.com

E-mail address of competent person responsible for the SDS: sds@gbk-ingelheim.de

1.4. Emergency telephone number

Emergency number : Tox Info Suisse: 145; +41 44 251 51 51

INTERNATIONAL: +49 (0) 6132 / 84463 (GBK GmbH, Ingelheim)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Hazardous to the aquatic environment – Acute Hazard, Category 1 H400
Full text of H- and EUH-statements: see section 16

Adverse physicochemical, human health and environmental effects

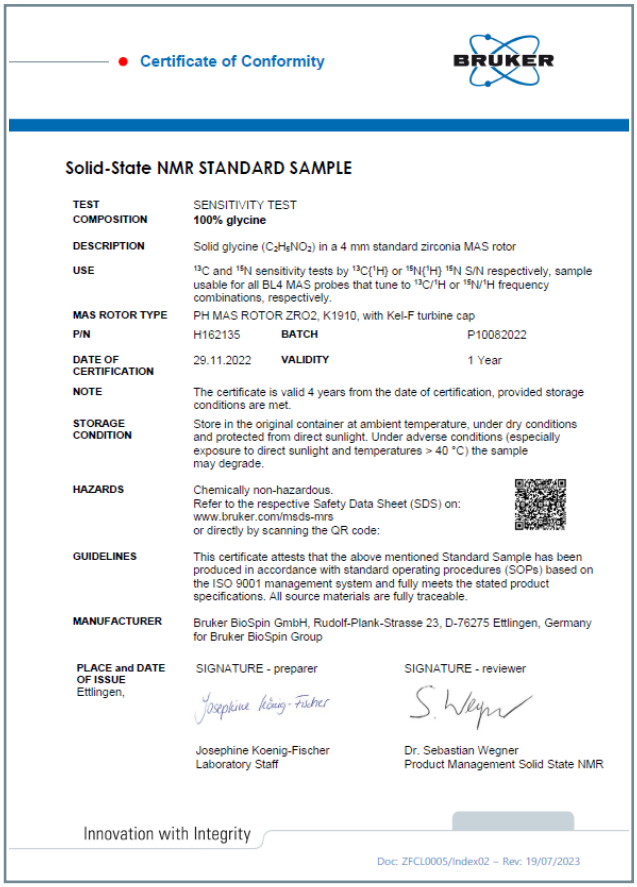
Causes serious eye irritation. Very toxic to aquatic life.

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :

4/26/2022 (Issue date) EU - en 1/10



Certificate of Conformity

Solid-State NMR STANDARD SAMPLE

TEST	SENSITIVITY TEST		
COMPOSITION	**100% glycine**		
DESCRIPTION	Solid glycine ($C_2H_5NO_2$) in a 4 mm standard zirconia MAS rotor		
USE	^{13}C and ^{15}N sensitivity tests by $^{13}C\{^1H\}$ or $^{15}N\{^1H\}$. ^{15}N S/N respectively, sample usable for all BL4 MAS probes that tune to $^{13}C/^1H$ or $^{15}N/^1H$ frequency combinations, respectively.		
MAS ROTOR TYPE	PH MAS ROTOR ZRO2, K1910, with Kel-F turbine cap		
P/N	H162135	**BATCH**	P10082022
DATE OF CERTIFICATION	29.11.2022	**VALIDITY**	1 Year
NOTE	The certificate is valid 4 years from the date of certification, provided storage conditions are met.		
STORAGE CONDITION	Store in the original container at ambient temperature, under dry conditions and protected from direct sunlight. Under adverse conditions (especially exposure to direct sunlight and temperatures > 40 °C) the sample may degrade.		
HAZARDS	Chemically non-hazardous. Refer to the respective Safety Data Sheet (SDS) on: www.bruker.com/msds-mrs or directly by scanning the QR code:		
GUIDELINES	This certificate attests that the above mentioned Standard Sample has been produced in accordance with standard operating procedures (SOPs) based on the ISO 9001 management system and fully meets the stated product specifications. All source materials are fully traceable.		
MANUFACTURER	Bruker BioSpin GmbH, Rudolf-Plank-Strasse 23, D-76275 Ettlingen, Germany for Bruker BioSpin Group		

PLACE and DATE OF ISSUE
Ettlingen,

SIGNATURE - preparer
Josephine Koenig-Fischer
Laboratory Staff

SIGNATURE - reviewer
Dr. Sebastian Wegner
Product Management Solid State NMR

Innovation with Integrity

Doc: ZFCL0005/Index02 – Rev: 19/07/2023

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