111kHz MAS 0.7mm Probe

To meet the challenges of magic angle spinning at very high rates (>100kHz), Bruker has developed the 0.7 mm MAS system which enables spinning rates up to 111 kHz. A prototype probe for the 1 GHz was tested with successful results.

The requirements of magic angle spinning at very high spinning rates (> 100 kHz) lead to miniaturization of air bearing systems and turbines. The basic principles of gas turbines and bearing systems need to be adapted to the sub-mm range of dimensions, requiring novel manufacturing techniques for rotors, turbine caps, drive systems, and air bearings with an outstanding precision. For the user of such systems, new challenges of sample preparation and rotor handling arise. Automatic and semi-automatic regulation of air flow for sub-mm MAS systems must be addressed.

The new 111kHz CPMAS probe (see figure 2) extends the BRUKER product range to MAS frequencies as high as 111kHz. With a sample volume of 0.5μl unsurpassed sensitivity in biological solid state NMR as well as in material science is provided helping in the elucidation of protein structures or the development of new battery materials.

To reach and maintain stable MAS frequencies above 100kHz, not only modern regulation hardware (MAS 3) needs to be available, but also super sonic conditions in air bearings and air drive need to be understood and controlled properly. In figure 2 an example of this supersonic drive flow can be seen.

The ultra-fast magic angle spinning capabilities of Bruker’s 111 KHz MAS probe allows for the direct and high resolution observation of proton resonances from complex biomolecules. We get double the resolution in protonated samples compared to 60 kHz spinning. As such it is a great new tool in our arsenal for the structure determination of proteins, a critical need for studying disease mechanisms.

- Prof. Lyndon Emsley, Ecole Normale Supérieure de Lyon

**Summary**
- Fastest available MAS frequency
- Stable regulation
- Unique possibilities in both biological solid state NMR and material science solid state NMR
- Available for standard- and wide bore
- Tools provided for easy filling and handling of the small diameter rotor and caps
- High sensitivity despite small sample volume by high mass sensitivity and high RF fields strength