

# (SS-NMR) Solid State Nuclear Magnetic Resonance Spectroscopy

## Principle

**Solid State NMR** is a technique capable of providing information about structure and dynamics of molecules. It provides a structural characterization of polymers, inorganics, inorganic-organic composite materials, etc.. Although the principle is common to the NMR in solution, the equipment requires specific accessories that allow it to obtain high-resolved spectra. The most important difference from liquid-NMR is the capability of investigating conformations, crystalline phases, molecular packing and intermolecular interactions.

**Time Domain NMR (Low Res)**. It is an alternative to classical NMR and is performed on a benchtop low-field instrument operating in time-domain only. From relaxation curves information regarding  $^1\text{H}/^{19}\text{F}$  content, rigid/soft phase content, water content can be obtained. Advanced investigations can also be performed, e.g. analysis of crosslinking, degree of polymerization and domain sizes in polymer-based materials.

## Capabilities

**SS-NMR**. Analyses can be performed on powders, soft rubbers and films. Depending on the sample constituents, suitable experiments are performed.

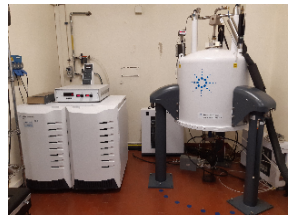
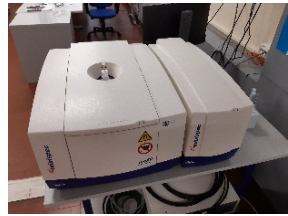
For example, the chemical structure of a common polymer is obtained with a multinuclear approach ( $^1\text{H}/^{19}\text{F}/^{13}\text{C}$ ), but more complex experiments or variable temperature measurements can also be run for assessing further structural information.

- T range:  $-40^\circ \leftrightarrow 100^\circ\text{C}$
- Most common investigated nuclei:  $^1\text{H}$ ,  $^{19}\text{F}$ ,  $^{13}\text{C}$ ,  $^{29}\text{Si}$ ,  $^{31}\text{P}$ ,  $^{27}\text{Al}$ ,  $^7\text{Li}$

**TD-NMR**. Analyses can be performed on liquid, solid or heterogeneous samples. The only limitation is that the sample can be inserted in a 10 mm glass tube. Quantitative investigations require a prior calibration with reference samples. Depending on customer needs, suitable experiments can be developed.

- T range:  $-80^\circ \leftrightarrow 100^\circ\text{C}$
- Nuclei:  $^1\text{H}$ ,  $^{19}\text{F}$

## Assets

	Asset	Details
	<b>Agilent Direct Drive 2 400 MHz NB spectrometer</b>	<ul style="list-style-type: none"><li>• 1.6 mm T3 MAS Special HFX probe (max spinning speed: 35 kHz, 3 channels probe: <math>^1\text{H}</math>-<math>^{19}\text{F}/\text{X}</math> (from 40 to 161 MHz)/<math>^{\text{Y}}</math> (from 61 to 100 MHz).</li><li>• 4 mm T3 MAS HX probe (max spinning speed: 18kHz, 2 channels probe <math>^1\text{H}</math> or <math>^{19}\text{F}/\text{X}</math> (from 40 to 161 MHz)</li></ul>
	<b>Bruker Minispec mq20 (20MHz, 0.5T)</b>	<ul style="list-style-type: none"><li>• <math>^1\text{H}</math> 10 mm probe</li><li>• <math>^{19}\text{F}</math> 10 mm probe</li></ul>

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