Improving solid-state NMR sensitivity using instrumentation, fast acquisition and post-processing

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Improving solid-state NMR sensitivity using instrumentation, fast acquisition and post-processing

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1 – Introduction

Solid-state NMR:
● Broad peaks
● Partial narrowing with MAS
● Low sensitivity

2 – Instrumentation

Complementary techniques:
● MACS: sensitivity increased by 8
● NUS: sensitivity increased by 2
● SVD: sensitivity increased by 2

Next step:
● Combining MACS + NUS + SVD: sensitivity increased by 32

4 – Processing

5 – Conclusion

7 – References


PSNRmax = H_signal / H_noise

Non-Uniform Sampling (NUS) [4-5]
Increase resolution
PSNR / √t / g → x 2

3 – Acquisition

Hydroxyapatite

Ca_{10}(PO_{4})_{6}(OH)_{2}

Inorganic part of bone

60 kHz
16.4 T
1.3 mm
2.5 mg
16 h

50 / 50, MTEOS (T) / TEOS (Q)

organic / inorganic hybrid material

PSNR = 3.2

2 – Improvement

Micro-quantities (100 µg)
PSNR / √t / g → x 8

Coupling between main coil and micro-coil

Singular Value Decomposition (SVD) [6-8]
Denoising
PSNR / √t / g → x 2
computation time / 100

Hydroxyapatite

Sensitivity

Imaging & correlation

PSNR

2.5 mm

Re-cycle to demagnetize for the next sample

8 mm 31P

1H

PSNR = 3.2

Macrowire

Coupling between main coil and micro-coil

Complementary techniques:

● MACS: sensitivity increased by 8
● NUS: sensitivity increased by 2
● SVD: sensitivity increased by 2

Next step:

● Combining MACS + NUS + SVD: sensitivity increased by 32

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PSNR

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