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

3 – Acquisition

4 – Processing

Sensitivity

5 – Conclusion

6 – Acknowledgements

7 – References


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

PSNR = \frac{H_{signal}}{H_{noise}\_peak} / 2

Hydroxyapatite

Ca_{10}(PO_4)_{6}(OH)_2

Inorganic part of bone

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

organic / inorganic hybrid material

PSNR_{max} = \frac{H_{signal}}{H_{noise}\_peak} / 2

+ 16.4 T

1.3 mm

60 kHz

2.5 mg

16 h

Hydroxyapatite

PSNR / sqrt(t) / g → x 8

Non-Uniform Sampling (NUS) [4-5]

Increase resolution
PSNR / sqrt(t) → x 2

Singular Value Decomposition (SVD) [6-8]

Denoising
PSNR / sqrt(t) → x 2
computation time / 100

PSNR / sqrt(t) / g → x 8

Magic Angle Coil Spinning (MACS) [1-3]

Micro-quantities (100 µg)

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• NUS: sensitivity increased by 2
• SVD: sensitivity increased by 2

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Stanislas Von Euw and Virgile Barret-Vivin are thanked for providing the samples
Laboratory head is acknowledged for its confidence
Colleagues are recognized for their encouragements and fruitful discussions

EUROMAR 2018, July 1st to 5th 2018, Nantes, France