Design, Construction, and Installation of 1.5-mm HTS Probe for 600 MHz NMR

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Introduction

NMR probes with High Temperature Superconducting (HTS) coils offer extremely high sensitivities. We previously designed a ^{1}H optimized 1-mm triple resonance probe.[1] Currently, we are designing two 1.5-mm probes that are optimized for ^{13}C detection, as well as maintaining the excellent ^{1}H sensitivity. Here, we report the progress in the development of these probes.

Experimental

Considering the approaches to coil design, two HTS probes (version 1 and 2) are being developed for this project. The build-out of version 1 of the probe was completed at the site of Agilent Technologies (Santa Clara, CA). The probe has recently been installed at the Advanced Magnetic Resonance Imaging and Spectroscopy (AMRIS) facility at the University of Florida. We are currently in the process of calibration of performance parameters and establishing the limits of detection for this probe. Initial results are displayed below.

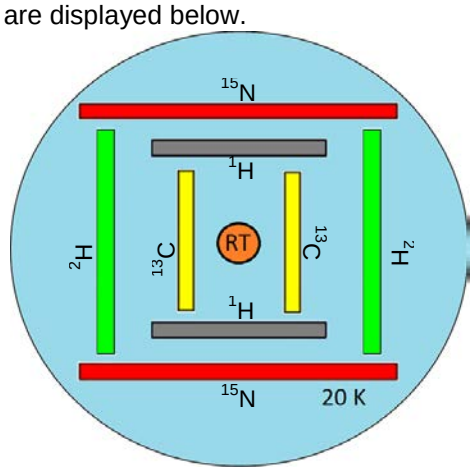

Figure 1: Coil layout within the version 1 probe

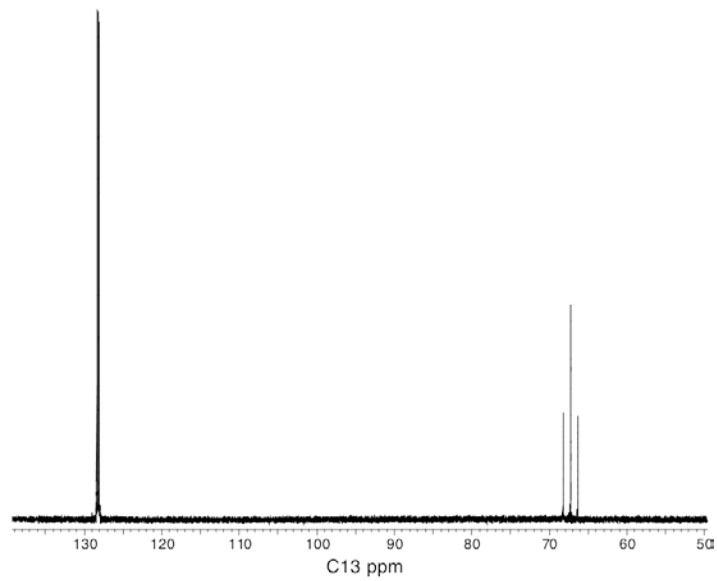

Figure 2: ^{13}C spectrum of the ASTM standard 40% dioxane in C_6D_6

Results and Discussion

When scaled up to a 5-mm sample volume, this probe exhibits significantly higher sensitivity for both ^{13}C and ^{1}H than the Agilent XSens probe and conventional cold probes.

Table 1: Measurements of 1.5-mm HTS version 1 probe

	^{1}H	^{13}C
90° Pulse Length	11.6 µs	15.5 µs
B_1 Homogeneity	94.3% (450/90) 84.4% (810/90)	86.3% (450/90) 61.0% (810/90)
S/N	495/1[a]	309/1[b]

[a] 0.1% ethylbenzene in $CDCl_3$ standard
[b] 40% dioxane in C_6D_6 ASTM standard

Acknowledgements

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References

[1] W. W. Brey, *et al.,* J. Magn. Reson., **179**, 290–293 (2006).