^{13}C CP MAS NMR of pharmaceuticals at ultrahigh magnetic fields

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^{13}C CP/MAS NMR spectra of halogenated solid organic compounds are often complicated by the residual dipolar coupling between carbon atoms and quadrupolar halogen nuclides (chlorine-35/37, bromine-79/81 or iodine-127). Similar effects are observed in the spectra of organic compounds containing quadrupolar nitrogen-14. Because this residual coupling is inversely proportional to the magnetic field strength, recording spectra at higher fields often results in significantly improved spectral resolution. In this project we investigate ^{13}C CP/MAS NMR spectra of a variety of organic compounds, including common pharmaceuticals and model drug compounds with covalently bound heavy quadrupolar halogens and nitrogen, at field strengths from 4.7 to 21.1 T, and demonstrate the advantages of obtaining such spectra at ultrahigh magnetic fields [1, 2]. The experimental results are supported by theoretical modeling and calculations. In favorable cases, the fine structure observed in spectra can be used for spectral assignment, e.g. for Cl-substituted aromatics where the substituted carbon as well as the *ortho*-carbons show distinct doublets.

Part of this research was featured on the cover of Crystal Grows & Design [2].

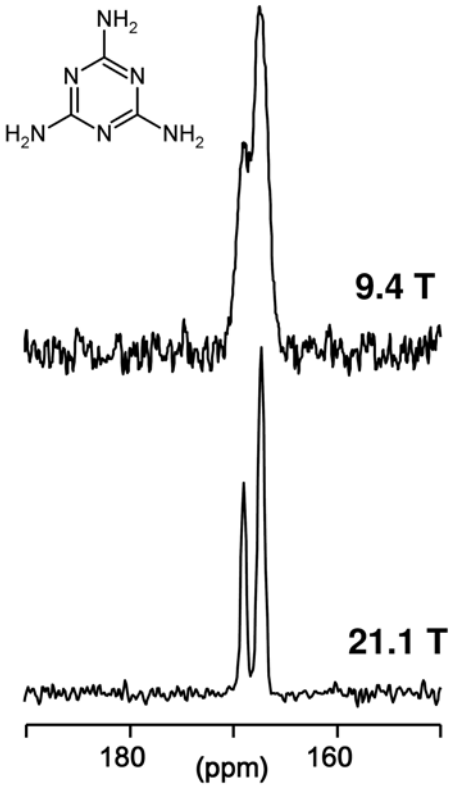

Figure 1: ^{13}C CP MAS NMR spectra of the same melamine sample recorded at two magnetic fields illustrating superior spectral resolution at 21.1 T in nitrogen-rich compounds.

When spectra are not complicated by large broadening and splitting due to residual dipolar coupling to quadrupolar halogen nuclides and nitrogen-14, it now becomes possible to apply the whole range of modern multinuclear NMR techniques to study such systems in detail. This approach will be of particular interest and importance in the pharmaceutical industry for polymorph identification, drug discovery and quality control.

[1] V.V. Terskikh, S.J. Lang, P.G. Gordon, G.D. Enright, and J.A. Ripmeester, *Magnetic Resonance in Chemistry* **47** (2009) 398-406.

[2] G.D. Enright, V.V. Terskikh, D.H. Brouwer and J.A. Ripmeester, *Crystal Growth & Design* **8** (2007) 1406-1410.