HIGH RESOLUTION $^{15}$N of FERROELECTRIC PHASE TRANSITION IN a SINGLE CRYSTAL of AMMONIUM SULFATE, (NH$_4$)$_2$H$_2$SO$_4$

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High Resolution NMR has been used for investigating the paraelectric-ferroelectric transition in (NH$_4$)$_2$SO$_4$ at $T_c$~223K. Initial $^{15}$N spectra were obtained on a Bruker DMX600 NMR spectrometer, but detailed measurements were made with a Varian UNITYINOVA 500 MHz wide-bore system. Variable temperature experiments with $^1$H-$^{15}$N cross polarization and proton decoupling with spinning speed of 5 kHz have been carried out. Figure 1 shows the spectra around the phase transition. The isotropic chemical shift exhibits an approximately linear temperature dependence within 2K of $T_N$, and then changes discontinuously, followed by another dependence which is shown in figure 2. The sharp anomaly around $T_N$ implies that the NH$_4^+$ ions undergo a displacive transition at $T_N$. This result provides a new avenue for studying ferroelectric transitions. 2D experiments will be performed to understand the phase transition mechanism better.

Figure 1. $^{15}$N MAS NMR spectra of (NH$_4$)$_2$SO$_4$ at different temperatures.

Figure 2. Plot of $^{15}$N chemical shift of (NH$_4$)$_2$SO$_4$ as a function of temperature.