

FIG. 2. Oscilloscope traces of $\lambda 5461$ absorption by 3P_2 mercury atoms versus field H_0 . A shows the decrease in absorption by paramagnetic resonance reorientation induced by a rf field of ~ 12.5 milligauss, B and C are for ~ 62.5 and ~ 250 milligauss. Radiation polarized parallel to H_0 was employed for A–C. D shows the increase in absorption when polarization perpendicular to H_0 was used; rf field ~ 62.5 milligauss.

Two weaker resonances corresponding to the $F=3/2$, $5/2$ states for the Hg^{199} isotope have also been observed at the expected field values. The extensions of the method to observe $\Delta F = \pm 1$ transitions for the odd isotopes which would allow a precision determination of the hfs are obvious.

The author wishes to express his appreciation to his colleagues for advice and equipment, and to Mr. D. A. Schow and Mr. J. Jonson for the construction of the potassium resonance equipment and of various excitation tubes, respectively.

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Ferroelectricity in the Langbeinite System*

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(Received June 29, 1956)

OPTICAL examination of $(\text{NH}_4)_2\text{Cd}_2(\text{SO}_4)_3$ over the range from room temperature to 77°K revealed a crystal transition about 10° above the lowest

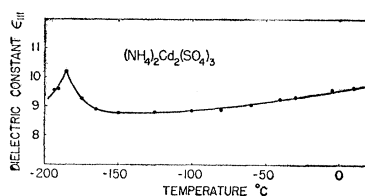


FIG. 1. Dielectric constant of $(\text{NH}_4)_2\text{Cd}_2(\text{SO}_4)_3$ as function of temperature, measured along cubic $[111]$ direction.

temperature. The material is cubic above the transition point, and belongs to the Langbeinite $[\text{K}_2\text{Mg}_2(\text{SO}_4)_3]$ family. An x-ray powder pattern establishes the lattice constant as $a = 10.350 \pm 0.005$ Å. Growth from water solution at 80°C results in predominance of octahedral (111) faces.

Dielectric measurements were made on plates cut perpendicular to the cubic $[111]$ direction. The behavior of the low-field dielectric constant ϵ_{111} as a function of temperature is depicted in Fig. 1. The room-temperature value of ϵ_{111} is about 9.5; the constant begins to climb slightly at -160°C , and reaches a peak of 10.2 at -184°C . Below this point, ferroelectric hysteresis loops are observed. The coercive field at -190°C is approximately 15 kv/cm for an applied field of 25 kv/cm, and the spontaneous polarization above the former $[111]$ cube direction is about 0.3 microcoulomb/cm². The hysteresis loops sometimes appear with noncentric symmetry, as in the case of guanidinium aluminum sulfate hexahydrate as reported by Holden *et al.*¹

Detailed dielectric, optical, thermal, and x-ray measurements on this and isomorphous crystals are in progress.

* Development supported by contracts with the Air Force Office of Scientific Research and the Signal Corps Engineering Laboratories.

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Effects of Superexchange on the Nuclear Magnetic Resonance of MnF_2

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(Received June 29, 1956)

NUCLEAR magnetic resonances of F^{19} in oriented single crystals of MnF_2 have been observed at 77°K, 195°K, and 310°K. Two broad F^{19} resonances were found (corresponding to the two nonequivalent fluorine sites in the unit cell) whose separation shift from the F^{19} resonance in a diamagnetic material, were functions of the external magnetic field, crystal orientation, and temperature.

Bloembergen and Poullis¹ have pointed out that for crystal orientations such that H_0 is contained in the a - b plane, two F^{19} resonances are to be expected while only one is to be found for H_0 in the b - c plane. With the former orientation we have observed the separate lines at 77°K, while at 310°K the lines were not resolved.