powers absorbed in the plasma at 100, 300, 500, and 800 $\mu$sec are 83.5, 12, 4, and 1.3 milliwatts, respectively.

At this low pressure in neon the return to the original trace after removal of the microwave signal is relatively slow, probably caused by the poor thermal contact between the electron gas and the gas of the plasma. Note that since the loss of electrons by diffusion is not negligible here as it was in the high pressure case (Fig. 1), the intensity of the recombination light does not return to the value it had before the beginning of the microwave pulse.

It appears that the phenomenon here described will be applicable to the study of electron-positive ion recombination processes which result directly or indirectly in light emission. In addition, the quenching of afterglow by absorption of low level microwave signals seems to be a valuable new method of detection of electromagnetic energy.

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[1] Goldstein, Anderson, and Clark, Phys. Rev. **90**, 151 (1953).
[2] V. A. Bailey and D. F. Martyn, Phil. Mag. **18**, 369 (1934).
[3] M. A. Biondi and S. C. Brown, Phys. Rev. **76**, 1697 (1949); Holt, Richardson, Howland, and McCline, Phys. Rev. **77**, 239 (1950).
[4] RCA 931-A for the very near ultraviolet and the appropriate blue region of the visible portion of the spectrum and a 1P25 image converter for the red and near infrared portion of the spectrum.

## Superconducting Compounds of Nonsuperconducting Elements

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THE superconducting molybdenum, tungsten, and bismuth compounds indicate that the metals Mo, W, and Bi themselves are on the borderline of being superconductors.

Thus far the only superconducting compounds of definitely nonsuperconducting elements have been CuS[1] and $CoSi_2$.[2] As such they seemed to be in a rather unique position.

The recent discovery of superconductivity in the (NiAs) and (MnP) crystal structures change this situation entirely. In the (NiAs) structure the following compounds of nonsuperconducting elements become superconducting:

$$\mathrm{PdSb}\sim 1.5^\circ\mathrm{K},$$
$$\mathrm{PtSb}\sim 2.1^\circ\mathrm{K},$$
$$\mathrm{PtBi}\sim 1.21^\circ\mathrm{K},$$
$$\mathrm{PdTe}\sim 2.3^\circ\mathrm{K}.$$

In the (MnP) structure it is

$$\mathrm{IrGe}\sim 4.7^\circ\mathrm{K}.$$

PtBi cannot be considered a typical Bi compound, as $PtBi_2$ should and does not become superconducting.[3]

The underlying working hypothesis will be detailed in a later publication.

[1] W. Meissner, Z. Physik **58**, 570 (1930).
[2] B. T. Matthias, Phys. Rev. **87**, 380 (1952).
[3] N. Alekseyevsky, J. Exptl. Theoret. Phys. (U.S.S.R.) **20**, 863 (1950).

## Reversal of Spontaneous Magnetization as a Function of Temperature in LiFeCr Spinels

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THE spontaneous magnetization of the ferromagnetic oxides having spinel structure[1] has been explained by Néel's hypothesis[2] of ferrimagnetism, or noncompensated antiferromagnetism. A preponderant exchange interaction between the magnetic moments on tetrahedral (8a)[3] and octahedral (16d)[3] sites, respectively, results in antiparallel alignment of these moments, and the spontaneous magnetization is thus the difference between the (unequal) partial magnetizations on tetrahedral and octahedral sites, respectively. This assumption has been amply verified by measurements of the saturation magnetization of various ferrites.[4–6]

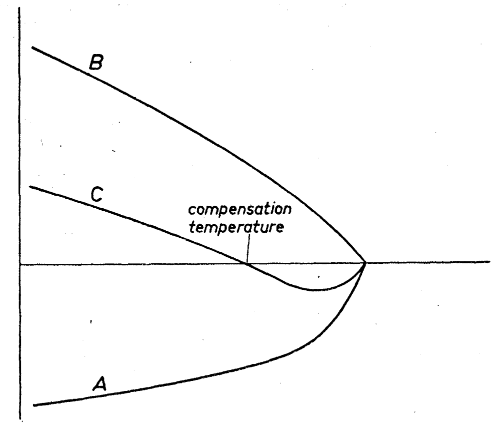


Fig. 1. A. Partial magnetization of tetrahedral sites *vs* temperature; B. partial magnetization of octahedral sites *vs* temperature; C. resulting spontaneous magnetization *vs* temperature. (After Néel, see reference 2.)

The application of the neutron diffraction technique[7] has provided direct evidence for the correctness of Néel's hypothesis.

Néel pointed out[2] that the Weiss molecular fields for magnetic ions in the two crystallographic positions will be different because of the difference in numbers and spin orientations of the respective neighboring magnetic ions. Therefore, the curves giving the decrease of the two partial magnetizations with temperature will have different shapes. Thus Néel foresaw the possibility of the existence *inter alia* of a spontaneous magnetization that changes sign at a certain temperature (see Fig. 1).

We have investigated the series of mixed crystal spinels[8] $Li_{0.5}^{+}Fe_{2.5-a}^{3+}Cr_a^{3+}O_4^{2-}$ between $a=0$ and 2.0 and have found that this phenomenon occurs between $a=1.0$ and 1.6.

The saturation magnetization of $Li_{0.5}Fe_{1.25}Cr_{1.25}O_4$ *vs* temperature is shown in Fig. 2, curve I. In order to ascertain whether indeed the spontaneous magnetization changes sign, a rod of the material was saturated at a low temperature: the remanent magnetization was then measured in the absence of a magnetic field (⊥ the earth's field) as a function of temperature. Curve II

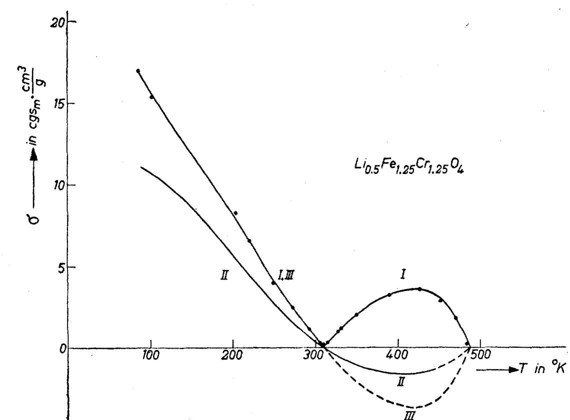


Fig. 2. I. Saturation magnetization of $Li_{0.5}Fe_{1.25}Cr_{1.25}O_4$ *vs* temperature. The points given are measured at 8000 Oe. Points measured at 6000 and 4000 Oe show no greater deviations from the drawn curve; II. residual magnetization of a rod of this material (arbitrary scale); III. spontaneous magnetization.