in the measurement of the thickness of the bismuth layer, of the intensity of the beam, and of the efficiency of the α-particle counter. The diagram indicates also the cross section σ_f for the fission of the compound nucleus Th^{223}, which is almost identical with the cross section for its production.[2]

The isotopes Rn^{212} and Rn^{211} may result from α-decay of the reaction products, with emission of neutrons only, (N, 3n) and (N, 4n), and may also be due to reactions with emission of α particles, (N, xα3n) and (N, xα4n), where $x = 1$ or 2. The dependence of the cross sections for the production of Rn^{212} and Rn^{211} on the energy of the nitrogen nuclei makes it possible to ascertain which one of these reactions is the more probable. The diagram shows (dotted) the calculated curves for the cross sections of the reactions (N, 3n) and (N, 4n). The cross sections are given in arbitrary units. It has been assumed in the calculations that $\sigma_{xn}(E) \sim \sigma_c(E) w_{xn}$, where $\sigma_c(E)$ is the cross section for the production of a compound nucleus by nitrogen ions with energy E, while w_{xn} is the probability of evaporation of x neutrons at a corresponding excitation energy of the compound nucleus.[3] Comparison of the experimental and calculated curves leads to the conclusion that the reactions (N, 3n) and (N, 4n) can give a decisive contribution (> 50%) to the yield of Rn^{212} and Rn^{211} only at nitrogen-ion energies less than 78 and 86 Mev, respectively. At large energies the yield of this isotope is obviously determined by the reactions of type (N, xα3n) and (N, xα4n). The possible shift of the position of the maxima for reactions with emission of only neutrons by 2 — 3 Mev towards the side of higher energies, which is due to the angular momentum of the compound nucleus,[4] does not change the conclusions substantially. Considering the cross section for the production of Rn^{211} for 83-Mev nitrogen ions to be the upper limit for the cross section of the reaction (N, 4n), we can estimate the value of the ratio Γ_n/Γ_f for the isotopes $Th^{223-219}$, namely $\overline{\Gamma_n/\Gamma_f} < 0.8$.

The isotopes with half life ~ 150 days is obviously Po^{210} (T = 140 days, E = 3.53 Mev), which is produced by various reactions such as (N, xαn), (N, p4n), (N, N^{13}), and several others. The cross section for the production of Po^{210} increases with increasing energy, and reaches $\sim 10^{-25}$ cm^2 at E = 100 Mev.

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MAGNETIC MOMENTS AND CURIE POINTS OF FERRITES OF THE Cu-Cd *SYSTEM*

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WE have studied the temperature dependence of the specific saturation magnetization σ_s and have determined the magnetic moments of solid-solution ferrites of the system $Cd_xCu_{1-x}Fe_2O_4$, in which the Cd^{+2} concentration was increased beyond 10% of the total number of bivalent ions. As far as we know, no one has previously carried out such studies of this system.

The specific magnetization σ was measured in the field interval 6000 to 13,000 oe, at six different values of temperature in the interval 78 to 293°K. The saturation magnetization at each temperature was determined by extrapolation to $H = \infty$ of the relation $\sigma = \sigma_s(1 - a/H)$. It was established that for the specimens rich in copper ions, and possessing the higher Curie points, the results of the measurements are best summarized by the formula $\sigma_s = \sigma_0(1 - \alpha T^{3/2})$. For the specimens rich in cadmium ions, with the lower Curie points, the relation $\sigma_s = \sigma_0(1 - \alpha T^2)$ holds. The absolute saturation magnetization σ_0 at each composition was determined by linear extrapolation to 0°K of the appropriate relation between σ_s and $T^{3/2}$ or T^2.

The curve in Fig. 1 shows the dependence of the magnetic moment, expressed in Bohr magnetons per "molecule" of the solid solution, on its composition. The dashed line shows the values of the magnetic moment calculated theoretically by assuming complete antiparallelism of the spins of the A and B sublattices. The deviations of the experimental data on the magnetic moment from the theo-

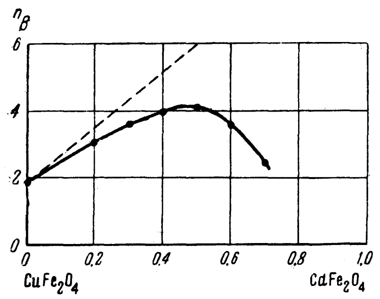

FIG. 1

retical values find an explanation in modern theory. In particular, Gorter[1] obtained similar moment curves for a number of other systems of mixed ferrites $MeFe_2O_4$-$ZnFe_2O_4$ and provided an explanation of them from the standpoint of Néel's theory; his explanation is also completely applicable to our system of ferrites.

It is known that the magnetic moment of copper ferrite, $CuFe_2O_4$, depends on the rate of cooling of the specimen. Néel explained this on the basis that the concentration of copper ions on A sites is a function of the temperature of the specimen. Rapid cooling to room temperature leads to retention of the ion distribution that existed at the quench temperature. This produces a higher percent non-inversion of the ferrite and increases its magnetic moment. The cooling conditions for our $CuFe_2O_4$ specimen apparently were not conducive to attainment of a stable equilibrium in the arrangement of ions in the lattice, since the magnetic moment of the specimen was abnormally large, being equal to 1.92 Bohr magnetons. To confirm this, we subjected our specimen to an annealing for 100 hours at $t = 370°C$. As a result of this annealing its magnetic moment decreased to 1.28 ± 0.02 Bohr magnetons which agrees well with Gorter's data.[1]

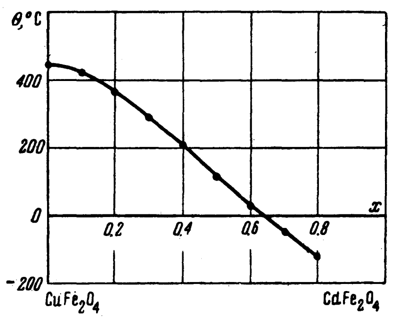

FIG. 2

The curve in Fig. 2 shows the Curie temperature Θ as a function of composition. A similar behavior of the Curie-temperature curve of this ferrite system was obtained earlier by Smolenskiĭ.[2,3] However, for our specimen of composition $CuFe_2O_4$, $\Theta = 450 \pm 3°C$, in agreement with the standard value of Θ for this composition, whereas according to Smolenskiĭ $\Theta \sim 425°C$. Accordingly our curve is higher in the neighborhood of the origin.

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POLARIZATION OF PROTONS IN SCATTERING BY C^{12}

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ANALYSIS of data on the elastic scattering of protons makes it possible to obtain sometimes sufficiently complete information on the position and characteristics of the levels of atomic nuclei. One such case is the scattering by C^{12}, at which the lower levels of N^{13} are excited.

Reich et al.[1] investigated elastic scattering of protons by C^{12} in the interval from 1.5 — 5.5 Mev and carried out a sufficiently complete phase analysis, whereby the following levels of N^{13} were identified: 1.698 ($\frac{1}{2}^-$); 1.748 ($\frac{5}{2}^+$); 4.808 ($\frac{5}{2}^+$), and 5.37 ($\frac{3}{2}^+$).

Measurement of the proton polarization due to scattering can supplement considerably our information on the levels of a given nucleus. Using the phase analysis given in reference 1, we have calculated the dependence of the polarization and of the cross section on the energy in p-C^{12} scattering in the energy interval 2.5 — 4.5 Mev at scattering angles 0 — 180° c.m.s. The principal results are shown in a diagram: The curves represent the energy dependence of the polarization at several scattering angles. The values of the polarization (particularly in the interval from 30 — 90°) are quite sensitive to the values of the D phases: for example, a 5° change in the $D_{3/2}$ phase at 4.5 Mev changes the value of the polarization in the forward angles by a factor of 2 or 3, while the cross