are most strongly excited.

---

[1] S. I. Aksenov and K. V. Vladimiskii, Dokl. Akad. Nauk USSR **96**, 37 (1954)

[2] A. Liav, *Mathematical Theory of Elasticity*, ONTI, 1935

[3] L. Bergman, *Der Ultraschall*, Zurich, 1954

Translated by M. Stevenson
148

The Fine Structure of the Spectrum of the Paramagnetic Resonance of the Ion Cr^{3+} in Chromium Corundum

A. A. MANENKOV AND A. M. PROKHOROV
P. N. Lebedev Institute of Physics, Academy of Sciences, SSSR
(Submitted to JETP editor February 26, 1955)
J. Exper. Theoret. Phys. USSR **28**, 762 (June, 1955)

THE paramagnetic resonance of chromium slats has been studied mostly in alums. The crystalline electric field, acting on a chromium ion in these combinations, has trigonal symmetry, and creates the splitting of two Kramers spin doublets (in the absence of an external magnetic field) in the interval from 0.12 to 0.18 cm^{-1}, depending on the type of alum[1].

We have investigated the spectrum of the paramagnetic resonance in a strong solution Al_2O_3- Cr_2O_3 (chromium corundum), at a chromium concentration of 0.05%. Earlier, this combination was investigated by Kashaev[2]; however, the author failed to explain the spectrum observed by him. We investigated the above-named combination at two frequencies, ν_1= 11970 mc/sec and ν_2=8960 mc/sec, at room temperature.

Chromium corundum represents a uniaxial crystal. When the axis of symmetry of the crystal is parallel to the direction of the applied external magnetic field, a fine structure of the spectrum of paramagnetic resonance is observed, consisting of three lines, which correspond to an electronic spin of Cr^{3+} equal to 3/2. At the frequency ν_2 =8960mc/sec. two of the observed lines are due to the magnetic dipole transitions $M = 3/2 \leftrightarrow 1/2$, and one of the lines is due to the transition $M = 1/2 \leftrightarrow -1/2$. The transition $M = -3/2 \leftrightarrow -1/2$ is not observed at this frequency, since the initial splitting of the levels $M = \pm 1/2$ and $M = \pm 3/2$, created by the internal crystalline electric field, is greater than $h\nu_2$. At the frequency ν_1 = 11970 mc/sec the observed lines of the fine structure are due to the transitions

$$M = 3/2 \leftrightarrow 1/2, \quad M = 1/2 \leftrightarrow -1/2,$$
$$M = -3/2 \leftrightarrow -1/2.$$

When the axis of symmetry is perpendicular to the direction of the external magnetic field, two lines are observed at the frequency ν_2 =8960mc/sec, and four lines at the frequency ν_1 =11970 mc/sec. Here in agreement with theory, the relative intensity of the lines depend on the angle between the axis of symmetry of the crystal and the direction of the radiofrequency field.

Assuming that the chromium ion is acted on by an electric field with trigonal symmetry, the observed spectrum may be described with the aid of the following Hamiltonian[1].

$$\hat{H} = D[\hat{S}_z^2 - 1/3\, S(S+1)] + g_{\parallel}\beta H_z\hat{S}_z + g_{\perp}\beta(H_x\hat{S}_x + H_y\hat{S}_y),$$

where D is a constant characterizing the splitting of the levels in the crystalline electric field, S is the electron spin, $\hat{S}_x$, $\hat{S}_y$, $\hat{S}_z$ are the components of the spin operator, g_{11} and $g_{\perp}$ are spectroscopic splitting factors corresponding to parallel and perpendicular orientation of the crystal with respect to the external magnetic field, β is the Bohr magneton, and H_x, H_y, H_z are the components of the magnetic field intensity.

The initial splitting of the spin levels in the absence of the magnetic field $|2D|$, was found to be 0.3824 cm^{-1}, which exceeds the splitting in alum by more than a factor of two. The g-factors are, $g_{\parallel}$ = 1.984 ±0.0006; $g_{\perp}$=1.9867 ±0.0006.

---

[1] B. Bleaney and K. W. H. Stevens, Rep. Progr. Phys., **16**, 108 (1953)

[2] S. Kh. G. Kashaev, Dissertation, Molotov University, 1954

Translated by D. Lieberman
147

The Radiation of CO_2 in the Region of 15μ in an Electric Discharge

N. IA. DODONOVA AND V. V. SOBOLEV
Leningrad State University
(Submitted to JETP editor January 2, 1955)
J. Exper. Theoret. Phys. USSR **28**, 764-766(June, 1955)

THE investigation of radiation from electric discharge through CO_2 in the region of 15