

FIG. 2. Core effective field, H_C , as a function of the maximum of the $3d$ orbital for $\text{Fe } 3d^8$.

which removes spin density from the region roughly between 0.5 and 0.75 a.u. will yield a substantial lowering of H_C . This can be devised while maintaining reasonable compatibility with the neutron measurements.

What is needed is a theoretical treatment which gives a more realistic description of the atom's

environment, the importance of which is indicated by the experimental results¹⁰ for Fe^{57} in Fe, Co, and Ni.

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⁸This is in large part due to lack of symmetrization, i. e., the total wave function is not, but should be, an eigenfunction of S^2 .

⁹It is apparently always the case that shape and not scaling is the important feature.³

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OPTICAL ACTIVITY IN TELLURIUM

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The crystal structure¹ of the elemental semiconductor, tellurium, has a symmetry which places it in an enantiomorphous class. Since this kind of symmetry constitutes only a necessary condition for the existence of optical activity, this effect was examined in single crystals and tellurium was found to have a large rotatory power. Thus, this is the first of the space-group-dependent properties to be measured in this semiconductor.

Both left- and right-handed single crystals were grown by the Czochralski method² which correspond to the space groups D_3^6 and D_3^4 , respectively.

Such crystals are levo- and dextrorotatory. At the initial stages of this work, all of our crystals were found to be dextrorotatory. This, of course, was to be expected since all of our crystals were "descended" from the same parent seed of a few years ago. The levorotatory crystals were grown from seeds which were randomly grown as needles in a hydrogen atmosphere. We would reasonably expect that such needles would have equal likelihood of being left- or right-handed. Quite fortuitously, a levorotatory crystal was grown on the second attempt.

The samples were cut into thicknesses varying

from 0.212 cm to 1.12 cm with plane parallel faces on the (0001) plane. The faces were lapped, polished in chromic acid, and oriented on (0001) with an accuracy of better than 0.5 degree. The latter is particularly important to prevent spurious interference effects.³ The measurements were made using a Perkin-Elmer, Model 112, single-beam double-pass infrared spectrometer with NaCl optics. Stacked plates of AgCl were used for polarizers, and advantage was taken of the inherent 30% instrument polarization by placing the second polarizer in the same polarization orientation. A well-collimated plane polarized beam was directed normal to the first face of the crystal, and the sample was rotated to insure that misorientations and misalignment effects were not present. This general procedure was found to give results which were in agreement with the published values⁴ for natural single crystals of α quartz.

It is conventional in optical activity experiments to express the specific rotatory power (θ/d) (quoted in units of degrees of rotation per mm of sample thickness) as a function of wavelength or wave number. The results for both levo- and dextrorotatory crystals are shown in Fig. 1, in which the abscissa is expressed in terms of the wave number $\tilde{\nu}$ (in cm^{-1}) so that deviation from normal rotatory dispersion can be seen.

These results may now be analyzed in terms of Fresnel's expression for the specific rotatory power:

$$\theta/d = 18(n_R - n_L)\tilde{\nu}, \quad (\text{degrees/mm})$$

where $\tilde{\nu}$ is in cm^{-1} . The quantity, $n_R - n_L$, is the difference in refractive indices for the ordinary and extraordinary rays in the direction of the optic axis. At $\tilde{\nu} = 0.20 \times 10^4 \text{ cm}^{-1}$ (5 microns), $n_R - n_L = \pm 1.58 \times 10^{-3}$, values some fifty times greater than for α quartz at $\lambda = 0.589$ micron.

From the curves of Fig. 1, it is seen that deviations from normal dispersion occur for $\tilde{\nu} > 0.20 \times 10^4 \text{ cm}^{-1}$. This is consistent with refractive index results reported by Hartig and Loferski⁵ and by Caldwell and Fan.⁶

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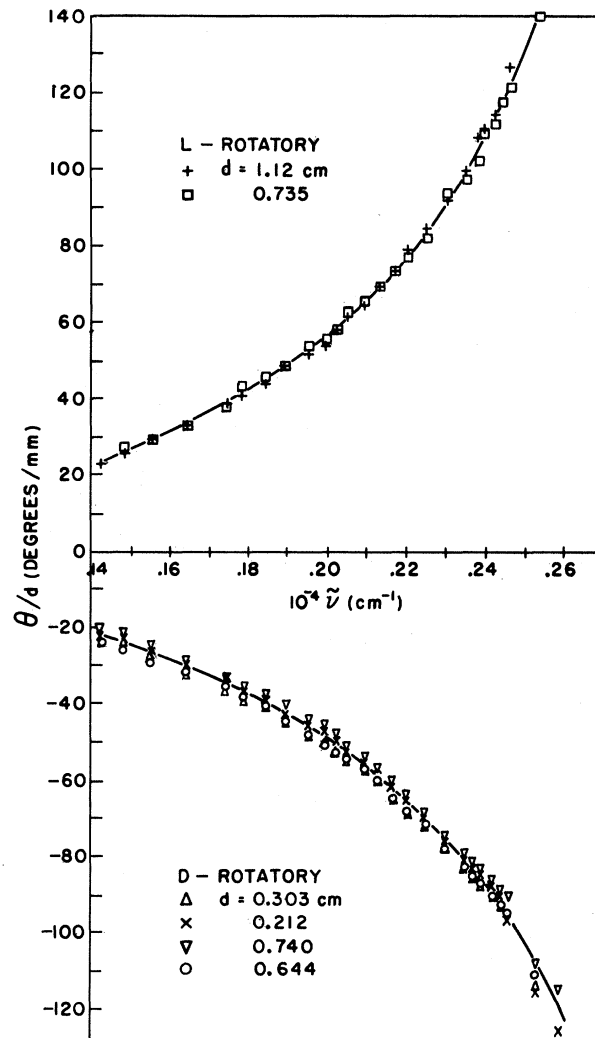


FIG. 1. The rotatory powers of dextro- and levo-rotatory tellurium as a function of wave number.

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