We have made measurements on transparent crystals of average size 8 × 4 × 1 mm, which rapidly become blue on exposure to the light. Spectral analysis (see table) was used to evaluate the purity, as was the density (measured by weighing in a liquid), which was 0.78 g/cm^3. These results indicate that the LiH was reasonably pure.

Type IIEV-1 capacitors [1] were used at 500 kc and 23°C to measure ε, which was found as 10.5 ± 0.26.

Measurements on ε were also made for single crystals of ZnS and LiF, which gave 8.15 ± 0.15 and 9.1 ± 0.1, which agree well with published values [2, 3].

The wavelength λ of the proper mode of LiH is given by Born's formula [3]: $\varepsilon = \varepsilon_\infty + 2.95 \cdot 10^6 (\rho \cdot \lambda^2 / M_1 \cdot M_2) \times (e^*/e)^2$, $\varepsilon_\infty = n^2$, n is the refractive index of LiH, ρ is density, M_1 and M_2 are the atomic weights of Li and H, and e^* is the effective charge on the ion; n is given [4] as 1.9, while e^*/e was taken [5, 6].

The formula gives $\lambda = 56.5 \times 10^{-4}$ cm.

Impurity Contents of LiH

Impurity	Mg	Sn	Mn	Ba	Si	Fe	Cu	Al	Ca	Na
Conc, %	0,01	0,17	—	—	0,15	0,14	0,003	0,009	0,0001	0,023

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THE SCALAR APPROXIMATION IN THE SCATTERING OF A PLANE LIGHT WAVE BY A SPHERE

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This approximation is obtained by replacing the solution to Maxwell's equations for monochromatic waves by the solution to Helmholtz's equation. Here I consider the limits to the applicability of that approximation for this problem (problem I) and illustrate one aspect of the approximation (a mathematically simpler means of finding a certain approximate solution). The above replacement has been discussed before [1-3] as regards the meaning of the scalar perturbation appearing in the theory of optical diffraction, but the question of the formulation of the boundary conditions has remained open.

It is usual to seek the solution to Helmholtz's equation for a sphere subject to the following boundary conditions at the surface of the sphere of radius r (problem II):

$$\psi + \varphi = W, \; P_0 \frac{\partial}{\partial r}(r\psi + r\varphi) = P_1 \frac{\partial}{\partial r}(rW),$$

in which φ, ψ, and W are functions describing the incident, external, and internal waves; φ represents a plane wave, while P_0 and P_1 are constants.

The exact solutions to problems I and II show that for small scattering angles (i.e., for directions differing only slightly from that of the incident wave) the solution to I may be put as 1/2 of the sum of the solutions to II with $P_0 = P_1 = 1$ and $P_0 = 1/P_1 = m$ (m being the relative complex refractive index of the sphere) without the spherically symmetrical s-waves. The first solution corresponds to the electric vibrations and the second to the magnetic ones.

Approximate solutions to II may be derived from the results of [4], in which it is shown that for small scattering angles and $kr \gg 1$ (k is wave number)

$$\psi = \frac{e^{ikR}}{R} \cdot \frac{ik}{2\pi} \iint\limits_{-\infty}^{+\infty} e^{i(xq_x + yq_y)} \left(1 - e^{-\frac{i}{2k}\int\limits_{-\infty}^{+\infty}(-V)\,dz}\right) dx\,dy = \frac{e^{ikR}}{R} A(\boldsymbol{k}_f, \boldsymbol{k}_0), \tag{1}$$

$q = k_0 - k_f$, k_f and k_0 being of magnitude k and having the directions respectively of scattering and of φ, R is the distance from the center of the sphere to the point of observation, $V = \hbar^2 U/2\mu$, U is the scattering potential, μ is the mass of a scattering particle; and $\hbar$ is Planck's constant. Formula (1) is true for vibrations of electric type, but these coincide with the magnetic ones for $kr \gg 1$ [5]. We may put +V as $+V = (m^2 - 1)k^2$ within the sphere and $+V = 0$ elsewhere, for then Helmholtz's equation formally coincides with Schrödinger's equation, whose solution is (1). The first term in (1) is the formula for Fraunhofer diffraction with this choice for +V.

From (1) and this +V we may calculate the scattered intensity $I = |\psi|^2$ and the attenuation factor $\sigma = (4\pi/k)\,\mathrm{Im}\,A(k_0, k_0)$ for $|m - 1| \to 0$, which gives us all the results of chapter 11 of [6].

The following formula is readily derived for the refractive index α of a medium containing N particles per unit volume:

$$\alpha = 1 + Nr^2 \frac{2\pi}{k} \left\{ -e^{-\rho \,\mathrm{tg}\, \beta} \frac{\cos\beta}{\rho} \cos(\rho - \beta) + \right.$$
$$\left. + e^{-\rho \,\mathrm{tg}\, \beta} \frac{\cos^2\beta}{\rho^2} \sin(\rho - 2\beta) + \frac{\sin 2\beta \cos^2\beta}{\rho^2} \right\},$$
$$\rho = 2(n - 1)kr, \quad \mathrm{tg}\,\beta = \varkappa(n - 1), \quad m = n - i\varkappa.$$

Also, (1) enables us to calculate the characteristics of a multilayer sphere; for instance, the attenuation factor of a transparent ($\chi = 0$) two-layer spherical particle is

$$\sigma = \pi r_2^2 (2 - X_1 - X_2); \quad X_1 = [2 - K(\rho_2, \beta_2)] \cdot [1 - r_1/r_2],$$
$$X_2 = 4 \int\limits_0^{r_1/r_2} \cos\left[\rho_2 \sqrt{1 - \xi^2} + \rho_2 [(n_1 - 1)/(n_2 - 1) - 1] \sqrt{(r_1/r_2)^2 - \xi^2}\right] \xi\, d\xi.$$

Subscript 1 relates to the core and subscript 2 to the outer shell; $K = \sigma'/\pi r_2^2$, in which σ' is the attenuation factor for a sphere of radius r_2 and having $m = n_2$ in this approximation.

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CALCULATION OF THE π-ELECTRON STRUCTURE OF SOME VINYL ETHERS BY THE SEMIEMPIRICAL SELF-CONSISTENT FIELD METHOD

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Values are discussed for the resonance integral of C–O (β_{C-O}) and for the parameter $\delta\omega_O$ of the oxygen atom for use in π-electron calculations for vinyl ethers by means of a semiempirical form of the MOLCAO self-consistent field method; $\delta\omega_O$ equals $\omega_O - \omega_C$, in which, in general, ω_i is the part of the coulomb integral $\alpha_i = \omega_i - \sum\limits_{j(\neq i)} N_j \gamma_{ij}$ dependent only on the type and valency state of atom i in the approximation used. The subscripts O and C correspond to oxygen and carbon, the γ_{ij} are the two-electron repulsion integrals, and N_j is the number of p- or π-electrons brought into the molecular structure by atom j.

The sequence of operations is as follows. First the electronic absorption spectrum (band with peak at 192 mμ [1],