ABSTRACT

THE STARK EFFECT OF M, N, AND Z_1 COLOR CENTERS IN ALKALI HALIDES

by

Larry A. DeWerd

Under the supervision of Professor John R. Cameron

The Stark effects of the M center in LiF, KCl, and NaCl; the N centers in KCl and NaCl; and the Z_1 center in KCl:Sr were measured with an alternating electric field. Measurements of the fractional change in intensity, $\Delta I/I$, which is related to the change in optical absorption coefficient, $\Delta \alpha$ versus photon energy were taken for the M bands in LiF, KCl, and NaCl. The data for LiF and NaCl were analyzed to find the difference in energy levels of the two mixing nondegenerate energy levels of opposite parity and the matrix element between these two energy levels when the electric field was applied. The values for the energy differences were: 1.27 ± 0.35 eV for LiF and 0.22 ± 0.02 eV for NaCl. The value for NaCl was obtained by making a slight correction for the overlapping of the R_2 band; the value without this correction was 0.24 ± 0.02 eV. The values for the matrix elements were: $1.3 \pm 0.2 \times 10^{-9}$ cm for LiF, $6.9 \pm 0.2 \times 10^{-9}$ cm for NaCl with the correction and $6.7 \pm 0.2 \times 10^{-9}$ cm for NaCl without the correction. Attempts were made to analyze the data for the M center in KCl; however, an effective

analysis could not be done because the data were complicated by an overlapping effect from the R_2 band. Measurements of the fractional change in intensity versus photon energy for the N centers in KCl and NaCl produced a range of energies where the values of $\Delta I/I$ were constant. The curves were resolved into two components representing the N_1 and N_2 bands. This was done both for light polarized parallel and perpendicular to the applied electric field. The fact that the N centers have a Stark effect with light polarized perpendicular to the electric field applied along a (100) direction suggests that the center has a resultant dipole moment that does not lie along a (100) direction. Results with unpolarized light for $\Delta I/I$ versus photon energy for the Z_1 center alone were obtained from the combined Stark effects of the F and Z_1 centers. Measurements with light polarized parallel and perpendicular to the applied electric field indicate the Z_1 center has a resultant dipole moment that does not lie along a (100) direction.

John T. Cameron