SYNOPSIS

In this thesis is reported a detailed and systematic analysis of the band spectra of halides of cadmium studied by high frequency oscillatory discharge and spectrographs with glass and quartz optics. A concentrated attempt is made in the present investigation in order to make as complete an analysis of various systems of bands as possible, consistent with the equipment available in the laboratory. The thesis is divided into two parts.

In the part I is given an introduction as well as historical background of the present topic. In order to make the thesis self-contained a brief account of the gross structure of bands, the intensity distribution in a band system and also the main object in selecting the molecules under study are described. A brief account of the usual sources to

excite the spectra of molecules is also given along with the details of the experimental techniques used in this laboratory, for exciting the molecules of interest in the present investigation. It is well known that the high-frequency electrodeless discharge is most suitable in such investigations. Hence it is used and described briefly in the thesis. One more unit of the same type for obtaining high-frequency discharge was also assembled here. It is described in detail in appendix.

Part second of the thesis deals with the results obtained on the band systems of the spectra of the halides of cadmium. The analyses of the band systems and the conclusions arrived at are described in detail. It was possible to obtain clear and well defined bands for the diatomic molecules CdCl, CdBr and CdI. The present investigation was confined to a detailed and systematic study of band spectra occurring in between red and ultra-violet regions.

These molecules (CdX) show extensive band systems ranging from the spectroscopic ultra-violet to visible regions. For the first time a detailed analysis of the bands in the visible region for these molecules is made and vibrational quantum formulae accounting for almost all the bands in these systems are derived.

The band system of CdCl molecule was found to extend from λλ3700-4900 A.U. About eighty bands were observed. They are well defined and are degraded towards longer wavelength side. A systematic analysis of these bands is made. The system is designated as due to a transition $B^2\Sigma \to X^2\Sigma$ and the vibrational quantum formula which accounts for all the observed heads is derived. In addition to this system, a second group of bands in the visible region lying between λλ5000-6500 A.U. and degraded on the longer wavelength side is obtained for the first time and tentative analysis is given for them.

For the molecule CdBr, a set of bands in the region λλ3920-4835 A.U. were reported by earlier workers. In the absence of any definite analysis of these bands, a reinvestigation of this system was undertaken. About one hundred bands lying between λλ 3900-4900 A.U. were observed in the present study. A detailed analysis of these bands indicates that they are due to a transition $B^2\Sigma \to X^2\Sigma$. Almost all the measured bands are accounted by the vibrational quantum formula derived for this system. The exist~~a~~ence of isotopic effect due to bromine is established. In analogy with the results obtained for CdCl molecule a system in the region λλ 5000-6500 A.U. was expected for the CdBr molecule. A preliminary study of the photographs gave positive results. These bands are degraded towards red. A tentative analysis for them is also given. In addition to these bands, a detailed investigation of the system in the Ultra-violet revealed the existance of a few fragmentary bands in the region λλ2350-2550 A.U.

In order to complete the molecular spectroscopic study of the halides of cadmium, study of cadmium iodide molecule was also undertaken. Spectroscopic analysis of the various systems of this molecule gave results resembling those of the molecules of cadmium chloride and cadmium bromide. For this molecule, about one hundred and fifteen bands in the region λλ 3850-4800 A.U. degraded towards red side were observed. The analysis indicates that they belong to the transition $B^2\Sigma \rightarrow X^2\Sigma$. In the regions 2350-2580 A.U. and 2800-3000 A.U. a few fragmentary bands were observed for the first time.

In the appendix are described the fabrication of the high-frequency high power oscillator and the discussion of some of the plates taken on plane grating spectrograph (PGS2) having a dispersion of about 7 A^o/mm in the first order. The high-frequency oscillator was designed in this laboratory and after obtaining all the relevant components it was successfully put into operation. It delivers a power of about 500 Watts at 60 M.c/sec. With the use of this oscillator the time of exposure was considerably reduced and better results, so far as the definitions of the plates are concerned, were obtained. The grating spectrograph could not be received in time and therefore the present work is reported by using the available equipment (Hilger E_2 glass and quartz spectrographs) in this laboratory. When the thesis was in preparation, this spectrograph was received. As such it could not be utilized fully for the present work. However, due to the limited time, some spectrograms were taken. The partial analysis of these spectrograms and their critical study have clearly supported the earlier conclusions arrived at by the present author.