CONCLUSIONS

The present investigation has been able to point out the plausible defects which can be considered to act as trapping sites in potassium chloride. It is suggested that the closest combination of the trap and the emission centre constitutes the phosphorescence centre. The emission centre can be any impurity ion. The impurity ions may be either those introduced into potassium chloride deliberately, or those present intrinsically in the host lattice below the level of spectrochemical detection. Recombination of the charge carriers of a particular sign, released from their traps at temperatures decided by the thermal stability of the trap, with the sessile carriers of the opposite sign takes place within the phosphorescence centres. The energy of excitation may either be liberated in the form of emission due to transition of the trapped charge carrier from emission level to the ground state within the emission centre or the excitation energy may be partially transferred to the emission centre after recombination of the charge carrier at the adjacent chlorine ion site. In both the cases the emission centre would be an impurity ion. An isolated Tl^+ ion in solid solution is suggested to yield emission in the ultraviolet whereas the emission centre formed by two adjacent Tl^+

ions is presumed to give rise to an emission in the visible. This assumption is purely tentative; but it is in general, compatible with the experimental observations reported in this thesis.

During the excitation of the phosphor with ultraviolet radiation, an electron from a chlorine ion may be transferred to the neighbouring Tl^+ ion, creating a hole and a chlorine atom. The hole is trapped at a positive ion vacancy residing on any of the six near neighbouring sites. The thermoluminescence peak around 200°K is suggested to be due to the excitation of the Tl^+ ion when the positive hole trapped at positive ion vacancy in the lattice and the electron trapped at Tl^+ ion recombine at the halide ion. In short, the glow peak at 200°K is associated with V_1 centres (Seitz's model).

The most important type of traps giving rise to glow peaks at 250°K observed in KCl quenched from the molten state, is considered to be the vacancy pairs, which are electrically neutral. The recombination of the electron trapped by the negative ion vacancy of the neutral pair, with its parent chlorine ion yields the luminescence emission which may be in the infra-red region. Part of the recombination energy is supposed to be shared by the adjacent emission centre which may be a divalent impurity ion existing inherently in the lattice. The colour centre involved in this case may be one of the Z centres.

The concepts of charged dislocations and the jogs created by the dislocation intersections have been used to explain the appearance of the peaks at 300 and 350 °K. A complex formed by a negative ion vacancy and the Tl^+ ion situated at a distance away from dislocation such that it is not measurably influenced by the dislocation charge, may be responsible for the 300°K peak. A similar complex in the vicinity of a charged dislocation where the electrical interaction is significant, may be associated with the 350°K glow peak. The appearance of various stages observed in the phosphorescence decay of the KCl:Tl phosphor at room temperature is explained on the basis of these models.

The undissociated complex ion centres of the type $(TlCl_n)^-$ are attributed to the glow peaks appearing at 140 and 175°K. The exact composition of the complexes has not been specified. The essential difference between the polyhalide ions (Cl_n^-) suggested here to form the trapping sites for the holes and those described previously viz., V_k and H centres is that the former species are formed along dislocations or sub-boundaries, whereas the latter species are the property of the undistorted lattice.

Thus one can see that the trapping sites in KCl:Tl can be related to the colour centres which are the properties of the host lattice. The premise of colour centre formation during phosphorescence or thermoluminescence processes can be very well supported by appropriate absorption measurements which will help to understand the role of each species of colour centres. However, other factors will have to be considered in the investigation of the kinetics for absorption processes. Such an analysis can most easily be applied to well-isolated absorption peaks, since overlap from neighbouring peaks can disturb the intensity values. For instance, in KCl, V_1 and V_k bands overlap. Similarly, the F band peak position is very close to that of the Z band. Because of this, it is difficult to obtain the experimental information about the role of the different species of colour centres in a clear and unambiguous way. However, a more concerted approach, in which the effect due to overlap of the absorption bands is minimised by eliminating one of the two species of colour centres responsible for absorption, would give valuable information. Work in this direction is proposed to be undertaken shortly after the arrival of an absoprtion spectrophotometer in this laboratory.