S U M M A R Y

This thesis embodies the study of the trapping sites and the luminescence emission associated with trapped electrons and holes, in potassium chloride in its pure form or activated with impurities. The disagreement between the theory and the experimental results of thallium-activated potassium chloride has come to the fore ever since Seitz[2] suggested the model for the above system of phosphors. The above model, which was later refined by Williams et al[3 to 7] assumed that the metastable levels of the impurity ions acted as traps for the excited electrons. In 1958, Joshi[9] observed that his experimental results on KCl:Tl did not permit the trapping sites to be identified with the impurity ions. He suggested that the traps for the electrons could be the imperfections in the host lattice other than the impurity ions. The present work was undertaken with a view to specify the nature of these traps more precisely. Thermoluminescence and phosphorescence are the experimental techniques employed in the study, since they form a versatile combination in the study of the trapping sites in a luminescent material.

The traps that are investigated correspond to those belonging to the thermoluminescence peaks at 140, 175, 200, 250, 300, and 350°K on the temperature scale. It is suggested that every thermoluminescence peak is the contribution of a particular type of colour centre in a perfect

or an imperfect region of the lattice. Nature of the emission centres for different types of phosphorescent centres are also discussed.

The thesis contains five chapters. The first chapter gives a general introduction to the aspects of luminescence phenomena in solids. The second chapter gives a brief account of the major characteristics of the imperfections in alkali halides viz., point defects, dislocations and colour centres. Among the colour centres, only those which have direct or indirect bearing upon the luminescence of 'pure' or doped potassium chloride excited by ultraviolet light at, or above liquid nitrogen temperature, are dealt with. A survey of the previous work on luminescence of alkali halides, with a stress on the trapping processes of electrons and holes, is made in the third chapter. Chapter No. 4 describes the experimental arrangement used in the present work. Present results and their discussion form Chapter No. 5. Every thermoluminescence peak has been found to be sensitive to a particular physical treatment and therefore it was necessary to discuss the peaks independently. The findings of the investigation are summed up in the Conclusions.