CONCLUSION

The experimental results indicate that the thermoluminescent behaviour of the NaCl:Ca system is influenced by three important factors :

i) the energy of the exciting radiation
ii) concentration of the impurity in the specimen and
iii) thermal and / or mechanical pre-treatment of the specimen.

The mechanism proposed for the emission of thermal glow peaks in NaCl:Ca specimens is as follows : In the process of irradiation (by ultraviolet or gamma rays) of NaCl:Ca phosphor at room temperature, electron and holes are created which remain trapped at defect centres. These trapped charges are released in the process of heating. The released electron meets the hole at the recombination centre (Ca - centre) with emission of photon. It is suggested that the trapping centres associated with the glow peaks have an important bearing on the presence of negative ion vacancies. Beside vacancies, dislocations are also believed to play a significant role in deciding the nature of the trapping centres.

The NaCl:Ca (10^{-3} m.f.) annealed and quenched from 750°C, herein called NaCl:Ca (T)

phosphor, is found to have high intrinsic TL sensitivity 253.7 nm UV radiation. The detailed study of the dosimetric properties of 167°C peak reveals that the NaCl:Ca (T) material is suitable for its use in radiation dosimetry.

The present investigations lead to the following conclusions :

(1) The thermal glow curves for 'pure' NaCl specimens display four glow peaks at 100, 137, 230 and 340°C. It is proposed that the close association of an inherent impurity-vacancy dipole with an adjacent negative ion vacancy forms the TL centre responsible for 100°C glow peaks, whereas 137, and 230°C peaks are observed to be the property of thermally pre-treated specimens. The TL centres in the latter case are therefore presumed to be located in the disturbed regions of the lattice. The glow peak observed at 340°C is suggested to be due to spurious thermoluminescence.

Deformation of thermally pre-treated 'pure' NaCl (annealed and quenched from 750°C) specimen induces glow peaks at 185 and 340°C which are erased during heating at 400°C in the first heating run. The deformation induced glow peaks are attributed to

some kind of metastable aggregates of the type reported by Miyake and Suzuki[99].

(2) A non-negligible concentration of Ca^{++} impurity incorporated in the base material (NaCl) gives rise to additional characteristic TL peaks not exhibited by 'pure' specimen. The incorporation of the impurity results in the development of new peaks at 167 and 185°C alongwith 137, 230 and 340°C glow peaks. The TL centres responsible for 137, 167 and 230°C peaks are presumed to have same components which however, differ in their configurations. The characteristic behaviours of 137 and 230°C peaks are explanable on the basis of the Ca - dipoles in association with negative ion vacancies in the dislocation regions. In the model proposed for these peaks, the negative ion vacancy is considered to be located as either next-nearest neighbour or next-next-nearest neighbour to the Ca - dipoles. The presence of metastable aggregates involving Ca-dipoles is attributed to the occurrence of 185°C peak . The centre responsible for 167°C peak is presumed to be a Ca-dipole in the dislocation region with a negative ion vacancy as its nearest neighbour.

Deformation of thermally pre-treated (annealed and quenched from 750°C) Ca^{++} doped NaCl specimen generates a dominant glow peak at 260°C for lightly doped NaCl:Ca (10^{-4} m.f.). This peak is suggested to be associated with the dislocation debris left in the wake of moving dislocations.

(3) The TL emission spectra of 'pure' NaCl specimen reveals that the unavoidably present Mg and Ca group impurities probably act as the emission centres whereas the deliberately incorporated Ca^{++} impurity is the site for the emission in NaCl:Ca specimens. In all the Ca^{++} doped specimens the characteristic emission of Ca at 375 nm is observed conspicuously .

(4) Examination of the characteristics of thermally pretreated NaCl:Ca (10^{-3} m.f.), designated as NaCl:Ca (T), suggests that the phosphor fulfills the requirements of a good TLD material. The TL output for the glow peak at 167°C (peak II) was measured after exposure to ultraviolet as well as gamma radiation for different doses. The plots of TL sensitivity of peak II versus UV dose (Jm^{-2}) are linear for both low as well as

high dose ranges. The same holds true in the case of gamma radiation for low dose ranges only. In view of the requirements of an efficient TLD material being satisfied by NaCl:Ca (T) phosphor, it is concluded that the phosphor is very well suited to act as TLD meterial in ultraviolet dosimetry work. Because of its suitability only for low dose ranges, its use in gamma dosimetry is limited.