CONCLUSIONS

From the results of the present investigations, the plausible models suggested for the luminescence centres in untreated and variously pretreated sodium bromide (doped and undoped) phosphors are as follows :

(i) A dominant emission band at 360 nm was observed in the emission spectra of all the undoped sodium bromide specimens subjected to heat and/or mechanical treatment. The intensity of this band was found to depend on the avilability oxygen and the temperature of quench. It is therefore proposed that the 360 nm emission band is the characteristic of the centre whose one of the constituents could be oxygen impurity.

(ii) It is suggested that in the case of lightly doped NaBr:Tl phosphors the 328 nm emission excited by the band at 268 nm arises in isolated Tl^+ ions occupying Na^+ positions in the perfect region of the lattice.

(iii) From the parallelism observed in the luminescent behaviour of solid NaBr:Tl phosphor, TlBr - -powder and aqueous TlBr - solution, it would be reasonable to assume that a substitutional Tl^+ ion in the distorted region of the lattice forms one of the components of the centre responsible for near ultraviolet emission. Because of the local lack of symmetry in the distorted region of the lattice, there is a significant possibility of Tl^+ ion forming a covalent band with one of the neighbouring Br^- ion giving rise to TlBr - molecule. The internal electronic transitions within such a molecule are suggested to be responsible for near ultraviolet emission.

(iv) It was observed that the band around 420 nm appears in the emission spectra of most of the untreated and pretreated NaBr:Tl specimens when the Tl content is high. At high Tl concentration the probability of two Tl^+ ions occupying nearest neighbour positions will be significant. It is therefore concluded that the emission band at 420 nm has its origin in Tl^+ ion pairs or dimers.

(v) From the consideration of the radius ratio $R_X:R_M$, where M stands for the metal ion and X for the halide ion, it is suggested that the solubility of Tl will be highest in NaI, lowest in NaCl and in between the two in NaBr. This is in accord with the results that dimers are observed in NaI:Tl$^{(115, 116)}$ but are not observed in NaCl:Tl$^{(135)}$.

(vi) The visible emission observed around 450 and 480 nm in heavily doped NaBr:Tl solid phosphor are also observed in the case of aqueous NaBr - solution containing varying amounts of TlBr . In both the cases there are two excitation bands out of which the principal one appears around 280 nm and the subsidiary about 250 nm. Thus, from the identical behaviour of solid NaBr:Tl phosphor and aqueous NaBr - TlBr solution, it is concluded that the visible emission at 450 and 480 nm in the case of solid NaBr:Tl phosphor arises due to electronic transitions in the complex ions of the type $(TlBr_n)^-$. In NaBr:Tl phosphor containing high Tl content, one would expect the excess Tl^+ ions to precipitate along the grown-in dislocations. These precipitated Tl^+ ions are complexed with certain number of Br^- ions to form different species of aggregates of the type $(TlBr_n)^-$.

(vii) The emission data in the case of heavily doped solid NaBr:Tl and TlBr:Na phosphors exhibit similarity with respect to 500 nm emission. In both the cases, the

500 nm emission is observed for excitation at 250 and 280 nm. It is therefore believed that these excitations and emission arise in Na^+ ions entering TlBr lattice substitutionally. In heavily doped NaBr:Tl phosphor TlBr is supposed to have precipitated out as a separate phase which would be conducive to the formation of Na^+ activated TlBr phosphor.

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