EMISSION SPECTRA OF Mn^{2+} IN BORATE GLASSES

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Strong dependence on exciting wavelength of the emission spectra was found in Mn^{2+} activated borate glasses. It seems that the phenomenon is to be explained by the loose network structure characteristic for glasses in general which enables the Mn^{2+} ions to form exchange coupled pairs and/or groupings.

Recently we gave an account of our observations concerning marked changes in the quantum distribution of Mn^{2+} emission, with changing wavelength of excitation, in metaphosphate glasses [1, 2, 3]. To clear up whether this dependence is due to special structural properties of the phosphate host glasses or to the manganese ions, the experiment was repeated using another host glass containing different amounts of manganese.

Experimental

The glasses of 15 wt% Na_2O—85 wt% B_2O_3 composition were prepared from $Na_2CO_3 \cdot 10\,H_2O$ and H_3BO_3 of reagent grade. 0,05—5,0 wt% manganese was added to the batch in the form of manganous acetate. After drying at 110 °C for 24 h the charges were melted in a gas furnace; slowly heated to 1050 °C, the melt being left at that temperature for 2 h and stirred from time to time. The melt was poured in stainless steel moulds of room temperature. Cylindrical samples of 16 mm diameter were cut and polished on both end-surfaces.

The phosphoroscope used for emission measurements has been described in detail elsewhere [2]. All spectra given below were determined by out of phase measurements.

As the results of chemical analysis reproduced the nominal manganese content within a 15% of error, the latter is given in the following to characterize the glasses.

Results and discussion

Emission spectra of glasses containing 0,5; 1 and 2 wt% manganese were measured at room temperature and at 100 K using exciting wavelengths from 405 to 620 nm. The most strongly exciting bandwidths were 6 nm. Just as in the case of magnesium and calcium metaphosphate glasses [2, 3], strong dependence on the

exciting wavelength of the emission spectra was found. Fig. 1 summarizes the effects of manganese concentration, temperature and exciting wavelength on the quantum distribution of emission by showing the dependence of the location of emission maxima on these parameters. By increasing the exciting wavelength, the emission

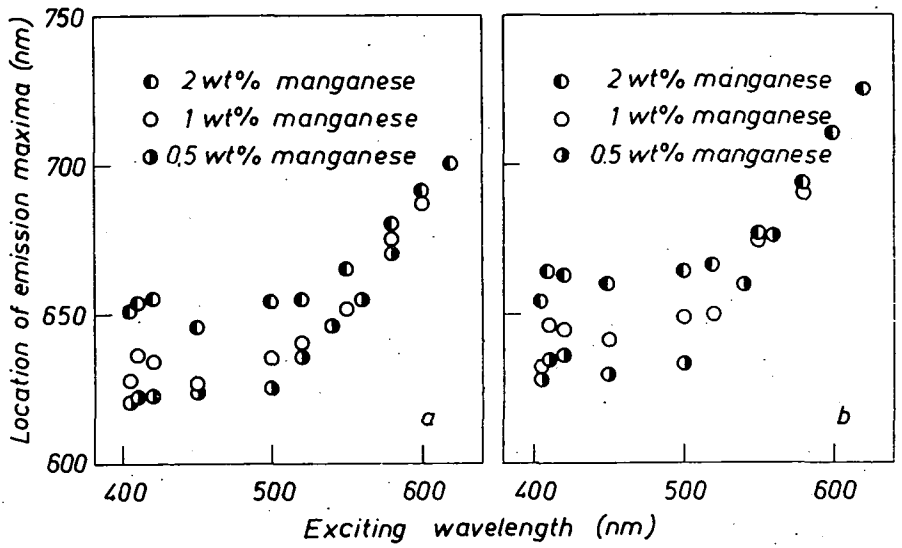

Fig. 1

spectra converge to a limiting spectrum independent of concentration. At room temperature, the maximum of the limiting spectrum is located at about 700 nm (Fig. 1*a*), close to the value of 725 nm given by GORBATCHEVA and KABAKOVA [4] as the long wave limit of the emission maxima from (phosphate) glasses containing manganese. At 100 K, the emission spectra are more red for all exciting wavelengths than those measured at room temperature; the maximum of the limiting spectrum lies at 725 nm (Fig. 1*b*)

The fact that the Mn^{2+} emission is dependent on exciting wavelength in borate glasses as well shows that the effect is not to be attributed to special structural properties of phosphate glasses. The phenomenon seems to be explained by the loose network structure characteristic for glasses in general, enabling Mn^{2+} ions to form exchange coupled pairs and/or groupings [5].

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ЭМИССИОННЫЕ СПЕКТРЫ БОРАТНЫХ СТЁКОЛ, АКТИВИРОВАННЫХ Mn^{2+}

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Описана сильная зависимость эмиссионных спектров боратных стекол, активированных Mn^{2+} от длины волны возбуждения. Явление объясняется рыхлой сетчатой структурой, характерной для стекол, которая способствует Mn^{2+} ионам образовать пары или группы связанные обменными силами.