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LETTERS TO THE EDITOR

Synthesis, Absorption Spectra, and Luminescence of Potassium Aluminosilicophosphate Glass Doped with Mn(II) Compounds

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Recently the interest in spectroscopic and luminescence properties of inorganic glasses doped with 3*d* elements (Ti, Cr, V, Cu, etc.) increased. These materials are used as active components in quantum electronics, optoelectronics, and fiber optics [1–7]. In this work we prepared potassium aluminosilicophosphate glass doped with Mn(II) and studied the spectroscopic properties of Mn(II) in this system.

The potassium aluminosilicophosphate glass doped with Mn(II) was prepared following the procedures in [8–10]. The charge was prepared from SiO_2 and potassium and aluminum metaphosphates. The components were thoroughly mixed, placed in a crucible, and kept at 1200–1250°C.

The ready glass was crushed to powder. Manganese was added in the form of MnO_2. Since the oxidation state 2+ for manganese is unstable, fusion should be performed in an inert atmosphere or in the presence of a reductant under appropriate conditions (temperature, time). Experiments showed that Mn(IV) is completely reduced to Mn(II) within 40–60 min at 1250°C with ammonium tartrate as reductant. The glass was annealed at 300°C in a steel mold for several hours.

The glass was visually colorless (MnO concentration 1.8 mol %, D_{410} 0.45, ρ 2.67 g ml^{-1}).

For spectral studies we prepared $10 \times 20 \times$ (3–4)-mm samples. The electronic absorption spectrum consists of several bands at about 410, 440, and 540 nm, which, according to [11, 12], were assigned to the $^6A_1 \rightarrow {}^4A_1$, $^6A_1 \rightarrow {}^4T_1$, and $^6A_1 \rightarrow {}^4T_2$ transitions, respectively. The electronic absorption spectrum of potassium aluminosilicophosphate glass is similar to those of Mn(II) in aqueous solutions and in other phosphate systems [11, 13]. The specific feature of the spectrum of the glass is the presence of a weakly pronounced shoulder at about 410 nm and the long-wave shift of the band of the $^6A_1 \rightarrow {}^4T_2$ transition.

Based on the electronic absorption spectrum of the potassium aluminosilicophosphate glass and published data [11, 13], we suggest the six-coordinate state for the Mn(II) ions in this matrix.

This conclusion was confirmed by the luminescence spectrum in the red region, typical of phosphate glasses [13]. According to the existing concepts, such emission of Mn^{2+} ions corresponds to the octahedral coordination [14, 15].

The electronic absorption spectrum was taken on an SF-56 spectrophotometer.

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