SYNTHESIS, PROPERTIES AND STRUCTURE OF INORGANIC COMPOUNDS. KINETICS AND MECHANISM

Sensory properties of solid solutions based on cobaltites of rare earth elements and bismuth ferrite

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The paper summarizes the results of the study of sensory properties of solid solutions based on rare-earth elements cobaltites $LnCoO_3$ (where Ln = La and rare-earth elements), and bismuth ferrite $BiFeO_3$. Cobaltites $LnCoO_3$ and their solid solutions undergo semiconductor –metal phase transition accompanied by the change in spin state of cobalt ions. Bismuth ferrite $BiFeO_3$ and its derivatives are the multiferroics and their Neel and Curie temperatures are above the room temperature ($T_N \approx 643$ K, $T_C \approx 1083$ K).

The investigated samples were prepared by a conventional ceramic method from the respective oxides of high purity [1] and specially developed sol-gel method [2, 3] using citric acid as the complexing agent. XRD analysis confirmed the individuality of the prepared samples. Sensory properties were investigated on thick film samples with silver contacts by means of the formula: $S = \frac{R_{gas} - R_{air}}{R_{air}} \cdot 100\%$, where S – the response (%), R_{air} – resistance of the film in the air, R_{gas} – resistance of the film in the gas-containing atmosphere.

We studied the sensitivity of the above films to the vapors of ethanol, butanol, acetone, diethyl ether, benzene, ammonia, etc. in the air.

It was shown that in all cases the dependence of S on T is nonmonotonic and had maximum lying in the region of the phase transition semiconductor–metal (in the case of solid solutions based on $LnCoO_3$) and between the Neel and Curie temperatures (in the case of solid solutions based on $BiFeO_3$).

It was also shown that the sensitivity of $Bi_{1-x}Ln_xFe_{1-x}Me_xO_3$ films has been significantly higher than that of the films based on $LnCoO_3$.

We also obtained calibration dependencies of the response of the corresponding thick films on the vapor content of the test substances (in ppm) in the air. For a number of substances they were close to the straight lines in a wide range of concentrations. The data obtained allowed us to fix quickly the achievement of lower and / or upper concentration limit of the vapors inflammation for combustible substances in the air and can be used in the development of the ecologically safe technologies.

References

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