Nanocomposite elements for HIC and sensors with a fusible glass matrix

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Functional basis of materials (pastes) for thick-film elements of hybrid integrated circuits and sensors are, as a rule, metal-oxide compounds of ruthenium, silver, palladium and gold and also oxides, carbides, boruides, nitrides, silicides of the other metals. Nanocomposite elements based on the "glass - metal compounds" are formed by the annealing of the pastes which are composed of a mix of superfine powders of a glass and a functional material which disperse in special organic binding agent. During the pastes annealing glass powders fuse and cake in a glass matrix in which particles of a functional phase are fixed, forming current-carrying circuits. Therefore the complex of physical properties of composite elements is appreciably caused by properties and structure of glass binding agent (the temperature of softenings begining, CLETR, specific surface resistance, chemical stability etc.). The basic lacks of known glass binding agents: the high temperature of softenings begining of a glass binding agent 580 - 750^0 C, which raises expenses of energy for nanocomposite manufacturing during their annealing (annealing temperature 800 - 900^0 C); presence of toxic lead connections.

In the work the processes of glass forming and crystallization and physical properties of glasses on the basis of system Bi_2O_3-SiO_2-B_2O_3-ZnO-MgO-CdO, CuO at different concentrations of initial components ratio are investigated. As the basic glass-forming component of a glass the bismuth oxide which enables receiving of more fusible glasses is selected instead of plumbum.

Optimum concentration of initial components and alloying impurities for reception of fusible glassy materials [1] are established.

Advantages of a fusible glass are: reduction of the temperature of a glass softening beginning (400 - 450^0 C); withdrawals from the glass compound of toxic lead; reduction CLETR; increasing of specific surface resistance 1.10^{14} - 5.10^{14} Ohm /cm. The glass does not crystallize in the interval of temperatures 300-1000^0 C. The glasses have II hydrolytic class.

Literature

[1]. Patent Ukrainy na vynahid №113565. Legkoplavke sklo dlya nanokompozytiv // Ya. I. Lepikh, T.I. Lavrenova. MPK C03C 3/062. publ. 10,02.2017, Byul. №3.