New Composite Material Based on Graphite Microparticles in Glassy Matrices for Applications in Piezoresistive Sensor

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Results of development of a new low cost piezoresistive composite material for use in pressure sensors are presented. Usually, piezoresistive sensors are fabricated using high sintering temperature glassy matrixes (frits) and conductive metal oxides like ruthenium oxide [1].

Here, the piezoresistive material is composed by porous glassy matrix with graphitic particles (~ 3 µm lateral dimension) as a conductive filler. Several different frit compositions (consisting of oxide mixtures PbO/ZnO/SiO_2/Al_2O_3, Bi_2O_3/B_2O_3/ZnO and Bi_2O_3/B_2O_3/SiO_2/Al_2O_3/ZnO) were developed and tested to provide low sintering temperatures (down to 600°C) in order to prevent burning of micrographite during final composite preparation [2].

A new methodology for producing piezoresistive films from pastes prepared using a frit powder, micrographite particles and an aqueous phase of sodium carboxymethyl cellulose (CMC) was developed. The resistances of films (with lateral dimensions of 50 x 5 mm) were measured to vary between ~ 1.2 and 142 kΩ, depending on composition.

The preliminary results showed that low-cost micrographite particles can replace expensive metal oxides like RuO_2 in piezoresistive sensors with comparable performance.

An important role of CMC in providing the paste homogeneity and good adherence of graphitic layers to glassy matrix was confirmed. The paste based on Bi_2O_3/B_2O_3/SiO_2/Al_2O_3/ZnO was proved to be the most stable under multiple flexure tests and it was successfully tested in piezoresistive sensors.

REFERENCES

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