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ELECTRONIC PROPERTIES OF PSEUDOBROOKITE NANOSTRUCTURED THICK FILMS

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Thick film pastes were formed using TiO_2 (anatase) and Fe_2O_3 (hematite) nanopowder in different weight ratios, organic vehicle and glass fritt. Two types of test matrices (sandwich and interdigitated) were screen printed on alumina substrate using conductive PdAg paste and sintered at 850°C/10 minutes in a conveyor furnace. The sandwich thickness and interdigitated electrode spacing were varied. UI characteristics were measured enabling determination of the voltage threshold typical for oxide semiconductors. Measurements of DC resistance vs. temperature enabled determination of the exponential factor B from NTC behavior.

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MAGNETIC PROPERTIES OF NICKEL MANGANITE OBTAINED BY A COMPLEX POLYMERIZATION METHOD

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Spinel materials based on Mn and Ni has been intensively studied over the past years due to their excellent semiconductor properties. Nickel manganite as NTC thermistor is widely used today in different industrial sectors. Here we report the complex polymerization method (CPM) for producing nickel manganite fine particles with a homogeneous distribution of constituent cations in the crystal lattice

that ensures formation of dense monophased ceramic with the novel magnetic properties after been sintered in oxygen and air atmosphere. Phase composition of the synthesized materials was examined by XRPD, while the morphology of the powder and microstructure of ceramic were investigated using FESEM and SEM analyses, respectively. The magnetic properties of the samples have been studied by measuring the temperature and field dependence of magnetization.

Magnetic measurements of M(T) reveal rather complex magnetic properties and multiple magnetic phase transitions. In the case of air atmosphere we found three magnetic phase transitions with transition temperatures at T_{M1}=35 K, T_{M2}=101 K and T_{M3}=120 K. T_{M1} maximum is strongly dependent on the strength of the applied magnetic field (T_{M1} decreases with increasing applied field) whereas the T_{M3} is field independent The values of the coercivity, remanent magnetization and saturation magnetization at 100 K are: H_C = 184 Oe, Mr = 1.92 emu/g and M_S = 7.88 emu/g, respectively. The measured values at 5 K are H_C = 1035 Oe, Mr = 7.70 emu/g and M_S = 14.47 emu/g. Moreover, hysteresis properties measured after cooling of the sample in magnetic field show exchange bias effect with an exchange bias field $|H_{EB}|$=196 Oe.

For the sample synthetized in oxygen atmosphere, the magnetization dependence of temperature M(T) and AC susceptibility data obtained from SQUID measurements clearly demonstrates that quadruple magnetic phase transitions can be readily detected at T_{M1}~115 K, T_{M2}~105 K, T_{M3}~38 K and T_{M4}~7 K. These findings suggest the novel magnetic transition for nickel manganite at low temperature T_{M4}. The temperatures of observed maximums in χ'(T) and χ''(T) parts of susceptibility are frequency independent, whereas the height of the peaks decreases with increasing frequency. The fact that T_{M4} does not shift with the increase of the frequency led us to the conclusion that there are no spin-glass/surface effect and/or blocking temperature/finite size effect connected to the $NiMn_2O_4$ ceramic. Therefore, the low-temperature peak T_{M4} in AC susceptibility is associated with ferromagnetic-like and antiferromagnetic-like magnetic transition in the interfacial FM/AFM internal structure. The exchange bias effect was found in a field cooled hysteresis loops at 5 K. The field cooling of the sample was under a magnetic field of 100 Oe and 10 kOe whereas the determined exchange bias fields were $|H_{EB}|$=129 Oe and 182 Oe, respectively. The analysis of the results and comparison with literature data allowed us to conjecture that the mixed oxidation states of Mn ions and ferromagnetic and antiferromagnetic sublattice orders tailor these interesting magnetic properties.