Synthesising and comparing electrical properties of NTC thermistors prepared from nanopowder and solid state reaction

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Abstract: In this research, NTC thermistors with composition of NiMn$_{2-x}$Co$_x$O$_4$ ($x = 0.4, 0.8, 1.2, 1.6$) prepared by two methods: solid state reaction and sol-gel (gel-combustion). The average particle size was monitored and structure of the calcinated powders have been investigated using x-ray diffraction (XRD) and tunneling electron microscopy (TEM) techniques. The average particle size was estimated to be about 65nm with the cubic and cubic + tetragonal phases for low and high cobalt concentrations, respectively. The grain size of samples verifies with scanning electron microscopy (SEM) images. Upon increasing the cobalt fraction, the grain size of samples increases from about 2µm to a few µm in size. The electrical properties of these thermistors depend on the grain size. The grain size of samples made from sol-gel is smaller than from solid state reaction under the same condition. For longer sintering time of the samples prepared by gel-combustion method, the grain size was increased then the electrical parameters of nanopowder improved and we obtain better results than the samples prepared from solid state reaction.

Keywords: gel combustion; NTC thermistor; nanopowder; spinel structure.

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