

SEGMENTED THERMISTORS PRINTED USING NTC NANOMETRIC PASTE ON ALUMINA AND Sr-FERRITE SUBSTRATES

T. Ivetić¹, B. Radojčić², M.V. Nikolić³, M. Luković², O. Aleksić³

1 Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000 Belgrade, Serbia

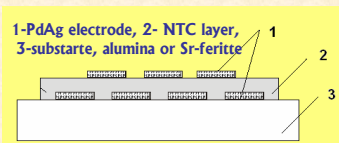
2 Faculty of Electrical Engineering, Bulevar Kralja Aleksandra 73, 11000 Belgrade, Serbia

3 Institute of Multidisciplinary Research, Kneza Višeslava 1, 11000 Belgrade, Serbia

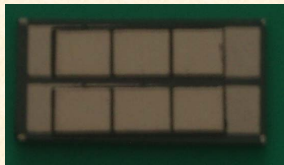
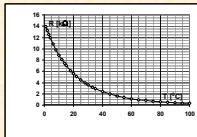
E-mails: tamara@itn.sanu.ac.rs, bradojic@yahoo.com, obradal@yahoo.com, marlav@rcub.bg.ac.rs, lukovicmiloljub@yahoo.com

Abstract - Thick film planar segmented NTC thermistors based on nanometer powder of complex spinel (NiMn₂O₄ doped with CuO) were screen printed on alumina and Sr-ferrite substrates. New planar thermistor geometry was applied to prepare custom designed temperature and water flow sensors. The influence of type of substrates and thermistor geometry on sensor characteristics were described. Particular attention was paid to their electronic and thermal properties with intention of forming a sensor with the most suitable thick film geometry and optimal electrical and time.

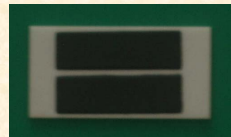
NTC SEGMENTED THERMISTOR



Temperature dependence of resistivity R



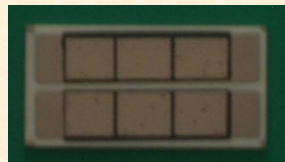
NTC thermistor on Sr-ferrite substrate



2-NTC layer

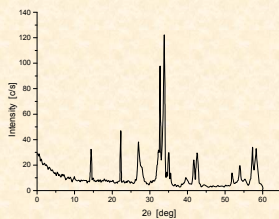


Bottom 1- PdAg electrode with 4 segments

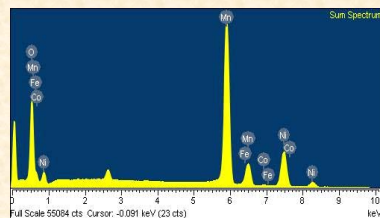


NTC thermistor on Alumina substrate

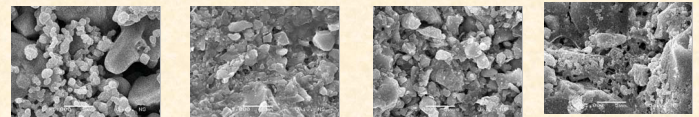
XRD OF NTC SINTERED THERMISTORS



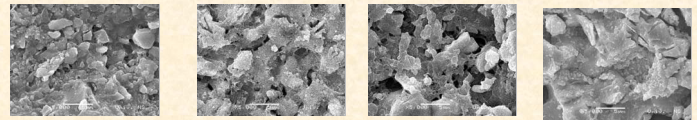
EDS diagram of NTC thermistor using complex (Ni,Mn,Fe,Co)₃O₄



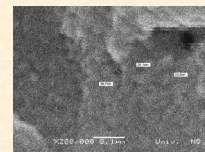
Scanning electron microphotography of samples sintered at 900°C (a) 1050 °C (b), 1200°C (c) and 1300°C(d) for 30min



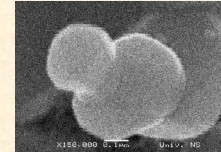
SEM microphotography of samples sintered at 1200°C for 30 min(a), 60 min(b), 120 min(c) and 240 min (d)



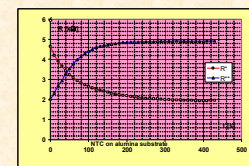
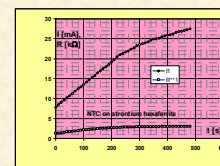
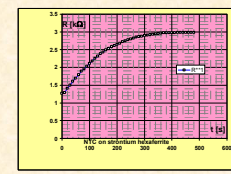
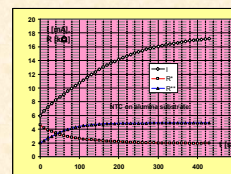
Nanometric structure of grains



melted nanograins (a)



Isolated nanograins (b)



NTC thick film inertia

Nanometer sized powder of nickel manganite doped with Cu, Zn, Co was used for preparation of thick film paste NTC-2010 IMSI. The thermistor exponential coefficient was determined as TCR $B = 3850 \text{ K}^{-1}$ from the $R(T)$ curve. NTC thick film segmented thermistors with reduced dimensions $25.4 \times 6.35 \text{ mm}$ have nominal resistance of $R = 5.59 \text{ k}\Omega$ which is a suitable value for application in fluid flowmeters. The inertia of the thermistor is much higher on substrate with a lower thermal permittivity such as strontium hexaferrite.