

# PASTE ON ALUMINA AND Sr-FERRITE SUBSTRATES

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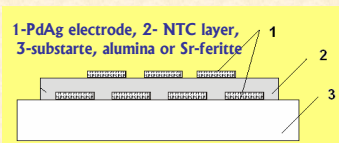
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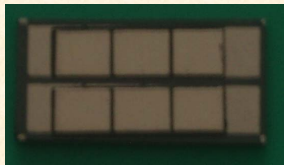
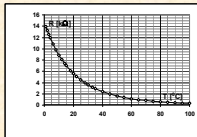
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**Abstract** - Thick film planar segmented NTC thermistors based on nanometer powder of complex spinel (NiMn<sub>2</sub>O<sub>4</sub> doped with CuO) were screen printed on alumina and Sr-ferrite substrates. New planar thermistor geometry was applied 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.

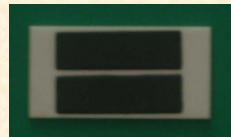
## NTC SEGMENTED THERMISTOR



### Temperature dependence of resistivity R



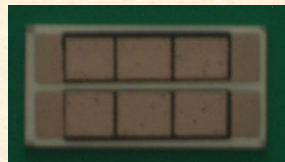
NTC thermistor on Sr-ferrite substrate



2-NTC layer

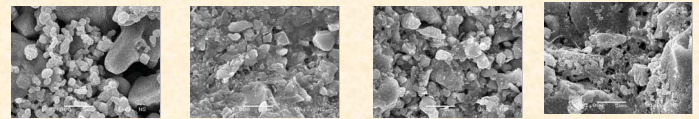


Bottom 1- PdAg electrode with 4 segments

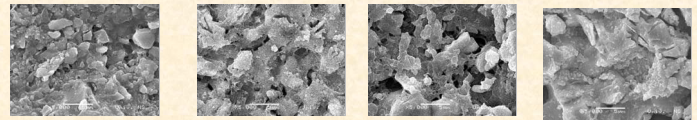


NTC thermistor on Alumina substrate

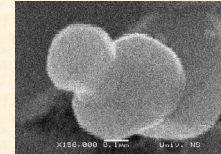
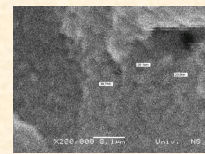
### Scanning electron microphotography of samples sintered at 900°C (a) 1050 °C (b), 1200°C (c) and 1300°C(d) for 30min



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



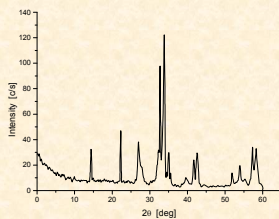
### Nanometric structure of grains



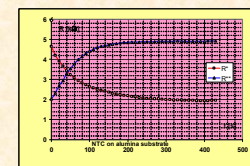
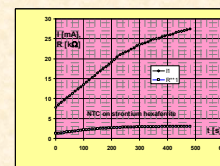
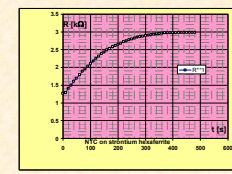
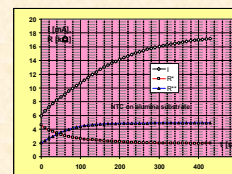
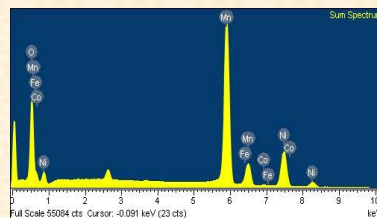
melted nanograins (a)

Isolated nanograins (b)

## XRD OF NTC SINTERED THERMISTORS



## EDS diagram of NTC thermistor using complex (Ni,Mn,Fe,Co)<sub>3</sub>O<sub>4</sub>



### 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.