Integration of thick-film PTC thermistors in Low Temperature Co-fired Ceramics (LTCC)

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Goal of the Study: ✍ *to achieve comparable reliability and reproducibility of the thermistor characteristics with LTCC as with standard alumina substrates*

The commercial series used and the firing profiles

ESL 8837-Au
DP 5744-Au
DP 9473-Ag/Pd
ESL 9562-Ag/Pd/Pt

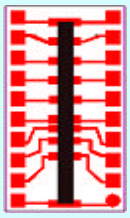
ESL 2612-I PTC
DP 5092 PTC
DP 5093 PTC

12 combinations are screen-printed and fired on multiple number of the following substrates

1. Al_2O_3 and *post-fired* DuPont (DP) 951- at 850°C for 10' in belt furnace

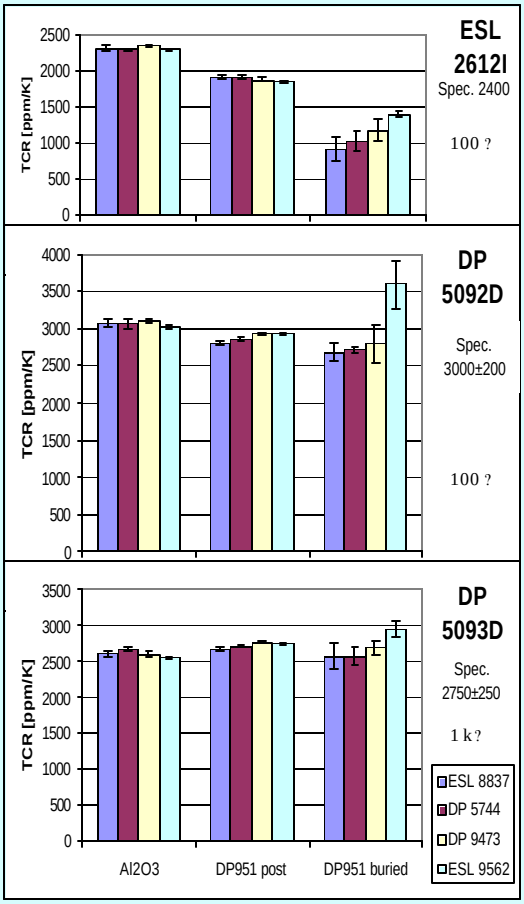
2. *Buried* DP 951- at T_{peak} of 860°C for 25' in lab furnace

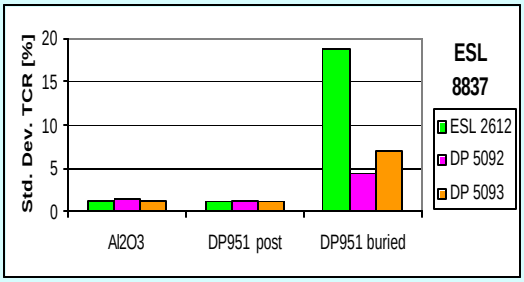
Test pattern



#	l	w
5	1.5	1.5
1	0.3	1.5
1	0.6	1.5
1	1.0	1.5
1	5.0	1.5

Results

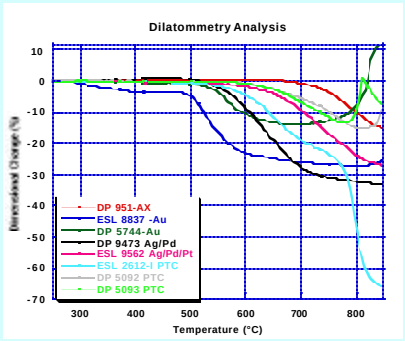


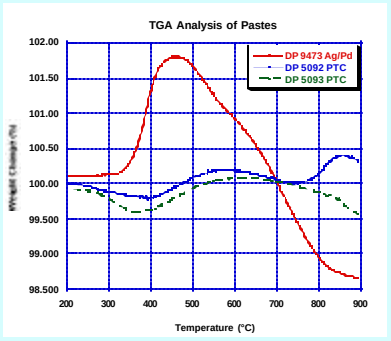


- ✍ ***small dispersion for reference and post-fired DP 951 substrates***
- ✍ ***TCR values close to the company specifications for DP pastes***
- ✍ ***small TCR difference between Al_2O_3 and post-fired DP 951 substrates for DP pastes***
- ✍ ***DP resistors as better choice compared to ESL for buried DP 951***
- ✍ ***large dispersion in buried DP 951***

Interpretation of Results

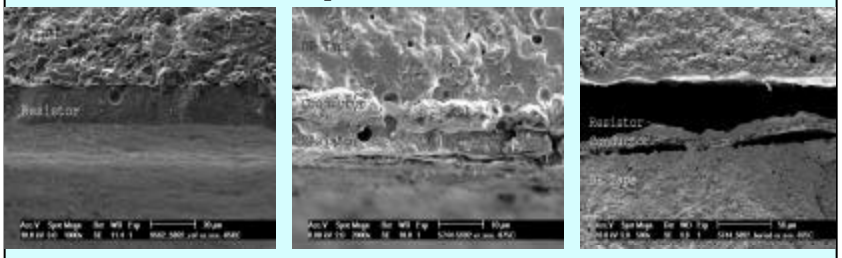
✍ Mechanical deformation due to difference in shrinkage or oxidation-related expansion in some pastes





✍ Chemical Interaction between the substrates and the pastes, stability of the printed lines after firing influence the electrical properties

Al2O3 **post-fired DP 951** **buried DP 951**



✍ EDS results show a diffusion-related change in elemental content of the components fired on post and buried (to larger extent) substrates