

Technical Paper

SCMA Vacuum compatibility

It is widely acknowledged that PZT materials are UHV compatible. When stacking such PZT elements the use of glue, solder, flux and wires could compromise the otherwise inherent compatibility for device level products. It is the purpose of this paper to give an estimate on outgassed species and rate from a Noliac Stacked Ceramic Multilayer Actuator (SCMA).

For this purpose a SCMA consisting of 4 CMA's and 2 endplates has been prepared. The overall dimensions of the SCMA are 5mm x 5mm x 10mm, having 5 glue joints each of 20mm length. The SCMA was equipped with standard buswire and 2 Kapton coated multi-core wires of 200mm length each.

Cleaning:

The excess glue is mechanically removed during the stacking process and during the curing. After curing the SCMA was brushed with a glass brush to remove any glue residues and wiped clean with acetone.

Test conditions:

The outgassing test was performed at Outgassing Services International, in accordance with the ASTM E 1559 measurement method.

Chamber pressure: 10^{-10} torr = $1,33 \cdot 10^{-10}$ mbar.

Measurement temperature: 23°C.

Test results:

- Total outgassed mass after 24 hours was $54.6 \mu\text{g}/\text{cm}^2$
- Outgassing rate after 24 hours was $2,0 \cdot 10^{-10} \text{g}/\text{g}/\text{s}$ equivalent to $4,6 \cdot 10^{-11} \text{g}/\text{cm}^2/\text{s}$. The outgassing rates are illustrated in the graphs below.
- Outgassed species was found to be predominantly water (98,7% by mass), but small traces of acetone and possibly fluorocarbons were also found.

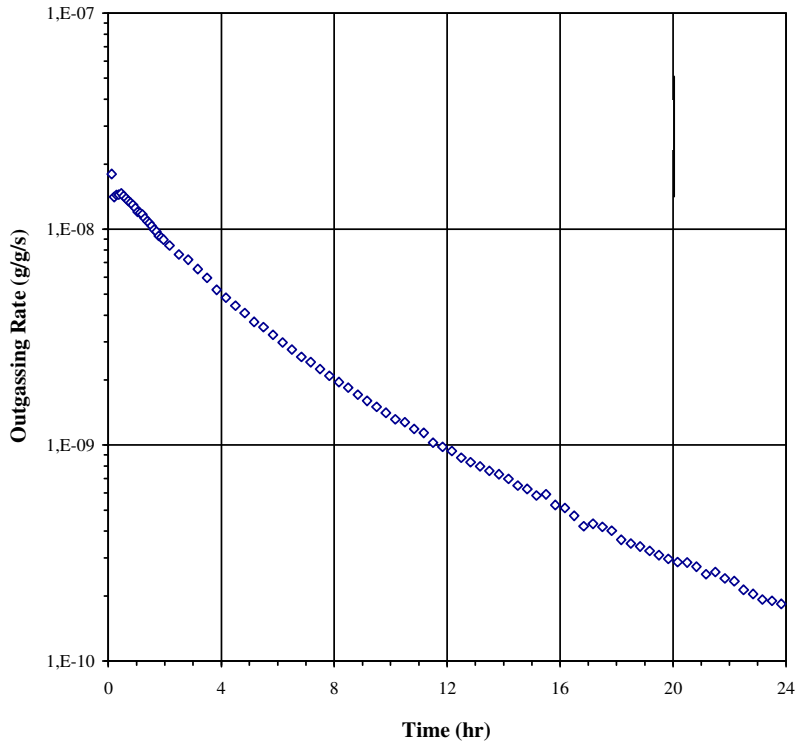
Analysis:

The presence of acetone most likely arises from a cleaning procedure performed after sample assembly and is therefore not considered as severe. The traces of what is believed to be fluorocarbons are presumed to originate from the glue used for the stacking, but the amounts detected are very low.

Conclusion:

By additional cleaning procedures and by using UHV compatible wires, the tested specimen exhibited only very low outgassing levels, proving the UHV compatibility of stacked actuators.

Multilayer Piezoelectric Actuator at 23°C.



Multilayer Piezoelectric Actuator at 23°C.

