

Ultra high vacuum



Noliac piezos are available in versions especially designed for ultra-high vacuum, UHV, applications. Testing exhibits low outgassing levels proving the UHV compatibility even of stacked piezo actuators with glue, solder, flux and wires.

DESIGN ACCORDING TO YOUR UHV APPLICATION

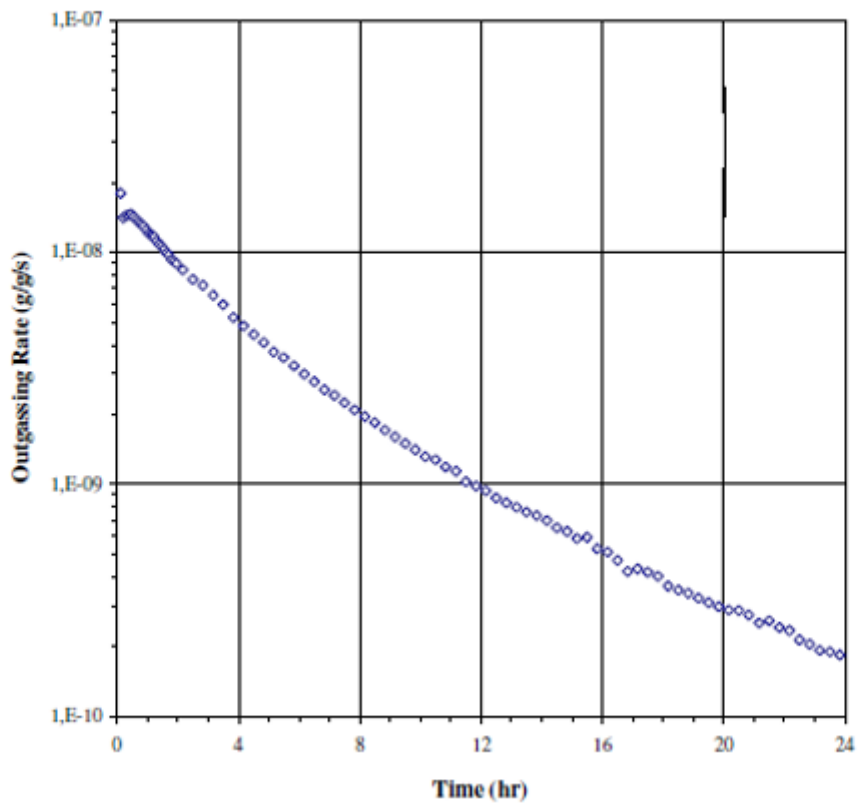
Noliac's piezoceramic components are made to support system development and integration of piezo technology in your UHV application. Among many technical capabilities, Noliac is competent in producing piezo ceramic components meeting the demands on temperature compatibility and out gassing levels set by UHV operation.

BASICS ON UHV

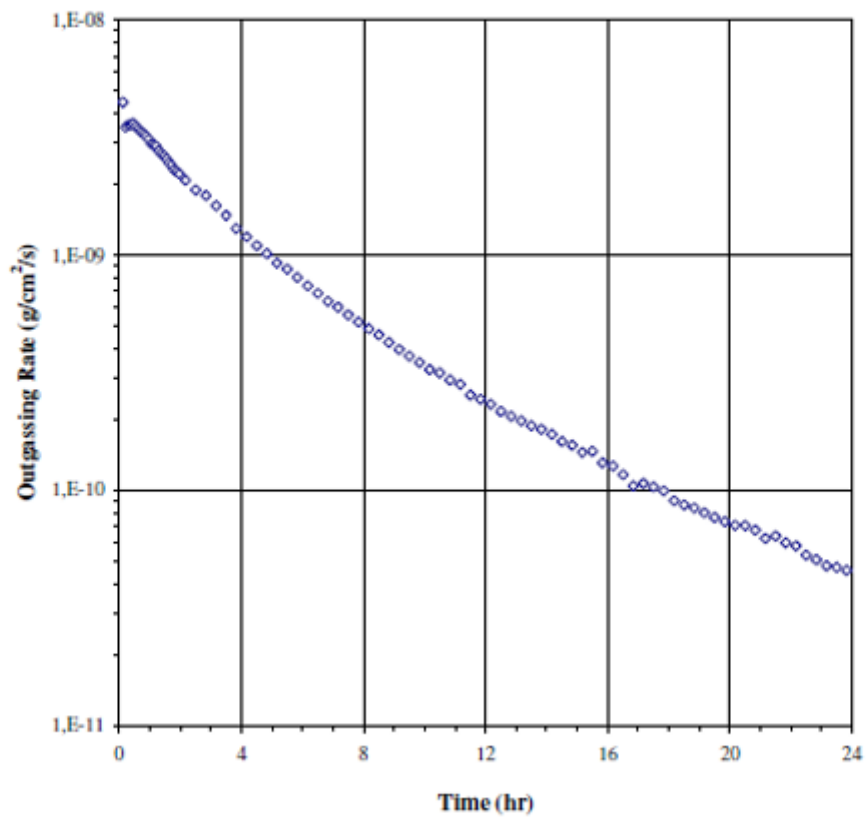
Ultra high vacuum is the vacuum regime characterized by pressures lower than about 10^{-7} pascal or 100 nanopascals ($\sim 10^{-9}$ torr). Extreme cleanliness and low out gassing are essential parameters in sustaining the vacuum level in such systems. Elevated temperature compatibility is often needed since water vapour and other trace gasses are removed from the system during a "bake-out".

TEST DATA

Multilayer Piezoelectric Actuator at 23°C.



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It is widely acknowledged that piezoceramic materials are UHV compatible. When stacking such piezo

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 test to give an estimate on outgassed species and rate from a Noliac plate stack actuator.

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

Cleaning

The excess glue is mechanically removed during the stacking process and during the curing. After curing the plate stack 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 = 1.33×10^{-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 $2.0 \times 10^{-10} \text{g/g/s}$ equivalent to $4.6 \times 10^{-11} \text{g}/\text{cm}^2/\text{s}$. 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.

CONTACT US AND LET US FIND THE RIGHT SOLUTION

If you have any questions about the possibilities for ultra-high vacuum, please use our Request for Quote form or [contact sales](#).