

## SHEAR MODE ACTUATORS - Additional characterisation

### Introduction

The purpose of this technical note is to provide users of shear mode actuators with information about:

- Aging under high field,
- Hysteresis,
- Impedance spectrum.

Tests were performed in Noliac Motion on standard CSAP02 actuators (5 x 5 x 0.5 mm). Other standards (CSAP01, CSAP03) give similar results.



Shear plate actuators

### Aging under high field

Shear mode actuators are designed for a maximum recommended voltage indicated on their datasheet. Above this voltage, a progressive degradation is observed. The purpose of this test is to document this aging effect.

Tests actuators were placed in a specific fixture under a given axial load. A sinusoidal voltage (0.5Hz) was applied and the displacement recorded using a high precision LVDT probe.

For a given peak-to-peak voltage, the sample is submitted to an increasing number of cycles (increasing the frequency, the last cycles being performed at 2kHz), its free stroke (peak-to-peak displacement) being measured regularly.

The results can be plotted on a log-scale graph. Two loading conditions were used (see figure 1 and 2).

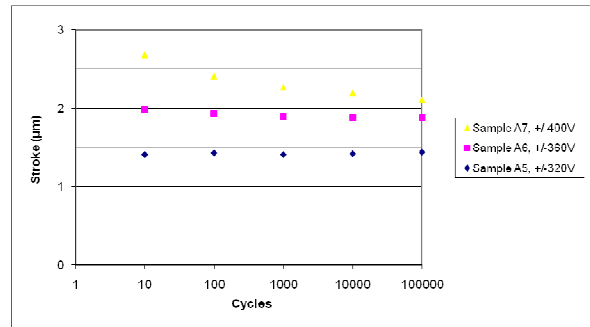


Figure 1 Aging results on CSAP02 under 36N axial loading

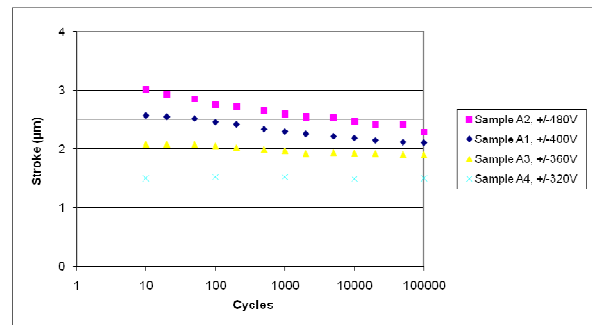


Figure 2 Aging results on CSAP02 under 26N axial loading

In the tested range, axial loading does not have an impact on aging.

As it can be seen, above the maximum recommended voltage shear actuators degrade following a logarithmic trend with regards to the number of cycles. The decay rate (in % per decade) can be identified on the graphs for a given voltage.

This feature is of importance, since it can allow driving the actuators with higher performance if only a few cycles are required.

## 1.1 Hysteresis

Hysteresis curves were drawn on several CSAP02 samples under 26N axial force. For this test, a driving voltage with amplitude corresponding to the maximum operating voltage and a frequency of 0.1Hz was applied (10s for a complete cycle). Displacement was recorded using a high precision LVDT probe.

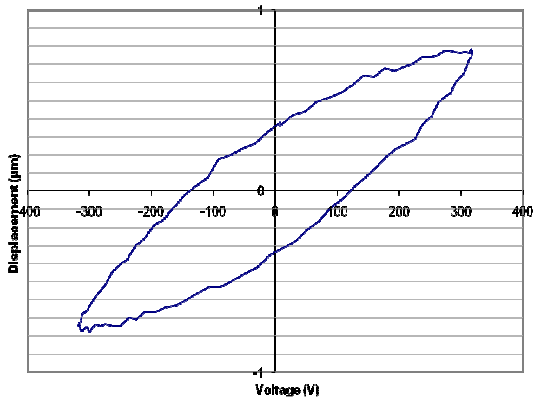


Figure 3 Sample hysteresis curve under 26N axial force

In these conditions, hysteresis is about 36%. The high value calls for a feedback system if accurate positioning is required.

## 1.2 Impedance spectrum

The full impedance spectrum of several CSAP02 was recorded using a gain/phase analyser. All results are consistent and a sample is shown below.

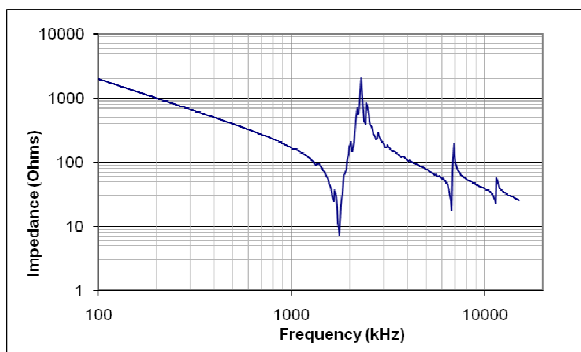


Figure 4 Sample impedance spectrum

As it can be seen, the impedance spectrum is quite clear, with only one resonance and its harmonics.