

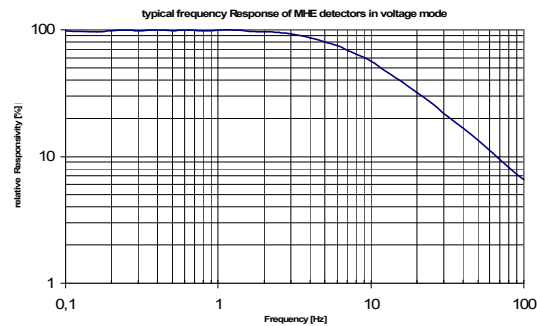
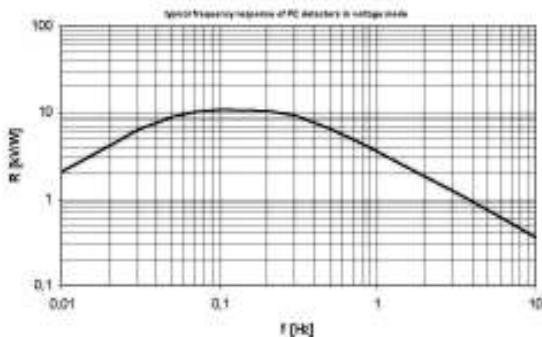


## REPORT

### ADVANTAGES OF MHE MEMS PYRO DETECTOR

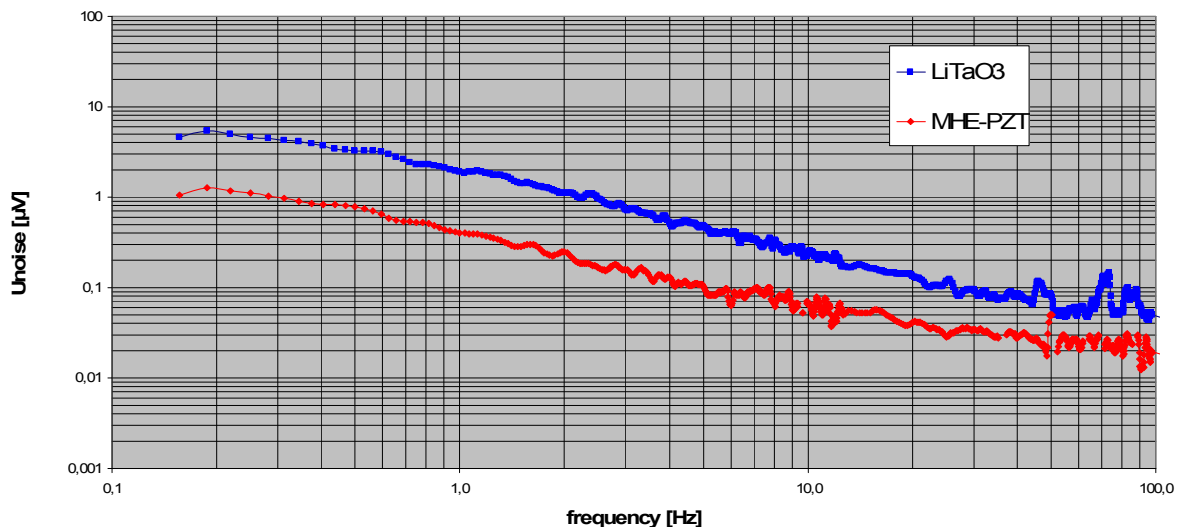
Unlike lithium tantalate (LiTaO<sub>3</sub>) based detectors, the Micro-Hybrid pyroelectric detectors use IR-chips which are made of PZT material. The chips consist of a MEMS style membrane structure with a 1 micron PZT sputtered film. The PZT material has a broad absorption range from 1.3 – 25 microns. This thin film technology has several advantages over lithium tantalate.

Because of the small mass and the thermal junction of the membrane to the Si -structure the thermal time constant is much lower than lithium tantalate detectors. The MEMS PZT detectors are faster. You can see this in a comparison of the frequency responses of detectors from typical LiTaO<sub>3</sub>, left side, and MHE MEMS, right side.



For detectors using the voltage mode the second cut-off frequency is determined by the thermal time constant. The MEMS PZT pyroelectric detectors have a higher cut-off frequency, approximately 9 Hz. Also the responsivity is constant over a broader bandwidth. Another advantage is a much lower settling time. This is the time a detector needs to return to normal operation after thermal shocks. The low thermal mass also contributes to a very low Johnson noise. Noise spike are virtually eliminated with the MEMS PZT material. A typically value for noise voltage is 60 nV/Hz<sup>1/2</sup>, measured at 10 Hz at a bandwidth of 1 Hz.

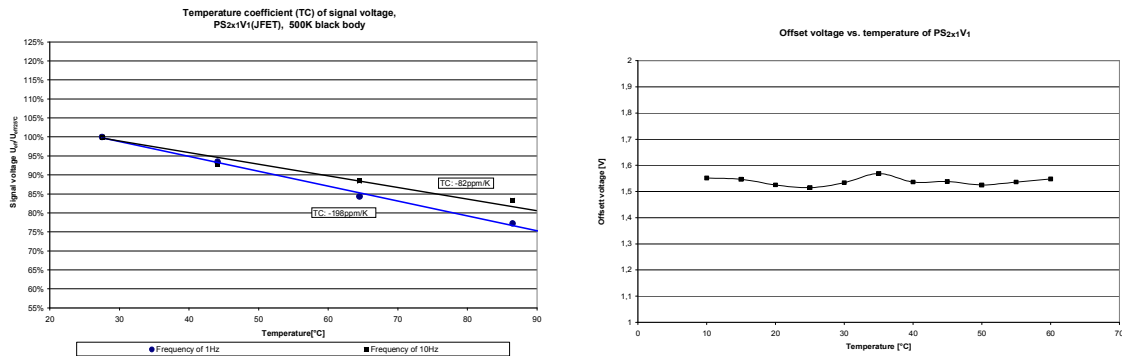
### Noise voltage



The combination of very low noise and high responsivity result in a high specific detectivity (2.0E+08 cmHz<sup>1/2</sup> /W typical) for our detectors in voltage mode.

## ADVANTAGES OF MHE MEMS PYRO DETECTOR

Another advantage of this low mass thin film structure on the stable membrane is low microphone effect. A Typical value is  $2.9 \mu\text{V/g}$  for voltage mode detectors. Another advantage is a low temperature dependency of the MEMS PZT material. There is no need for a thermal compensation. This is shown in the following diagrams.



On the left side the temperature coefficient is shown for frequencies of 1 and 10 Hz. For a typically application frequency of 10 Hz the MEMS PZT detectors have a typical TC of -82ppm/K. On the right side you can see the offset voltage which is constant across a high temperature range. MHE also offers these pyroelectric detectors for temperature range up to 180°C, by using special housing technology.

MHE, 2010-06-24