



Process monitoring with DBLI



Stephan Tiedke  
CEO aixACCT System

Dear Customers,

There are a couple of companies ramping up their PZT MEMS fabrication to mass production with a significant volume of wafers per year.

We are accompanying these companies since a couple of years and have supported their product development with various tools. Now, either these companies or appointed MEMS foundries will produce several million devices per year.

This is really excellent news to our industry field. During the PZT process qualification phase various kind of structures have been tested, among them large cantilevers that are diced out from wafer and also small etched cantilevers on 8inch wafers as well as regular PZT stacks. Diced cantilevers as they are used for ax4PB four point bending test bench offer high accuracy down to or better 1% error level, suitable for poling studies for example.

The reproducibility of etched cantilever structures did not allow process control, but PZT stack structures as they are used for our aixDBLI tool allow process qualification.

Customer said, we gain confidence in our process due to DBLI data. Beside the process qualification the DBLI tool is also capable of process sensitivity.

That is why aixDBLI tool will be a fixed part of piezoMEMS production lines. Due to the fact that piezoMEMS community trusts in aixACCT and its unique products and because these products have accompanied and supported today's successful piezoMEMS products.

Sincerely yours,

A handwritten signature in black ink, which appears to read 'Stephan Tiedke'. The signature is written in a cursive, flowing style with a large, stylized initial 'S'.

## aixDBLI

### Research Line DBLI



The aixDBLI tools were developed to measure the thickness change of thin films. It represents the final stage of expansion of aiXACCT measurement system. Based on the aiXPES system it continues the modular design concept which results in two main system lines. The research line tools focusing on high flexibility and modularity and the industrial line tools focusing on a high automation level and high reliability and reproducibility. Both lines have the well approved double beam technique in common.

The DBLI technique ensures measurements of thin film thickness changes under electrical excitation with a proven accuracy (x-cut quartz) of 0.2 pm/V.

### Industrial Line DBLI

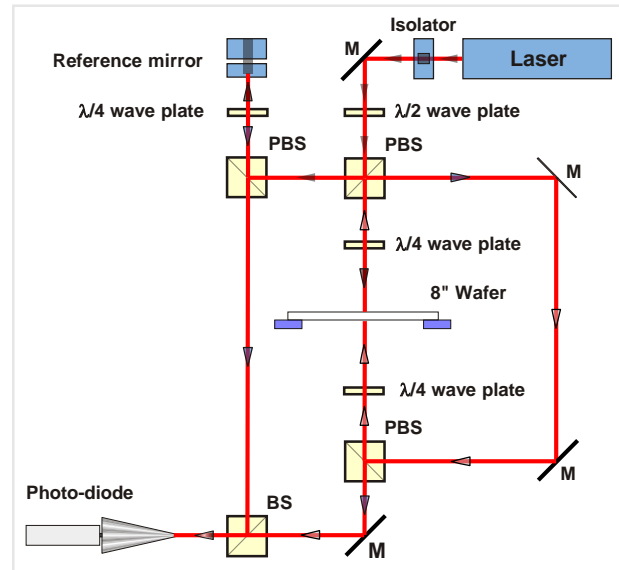
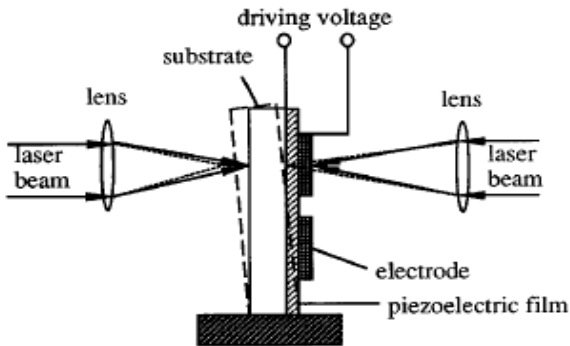
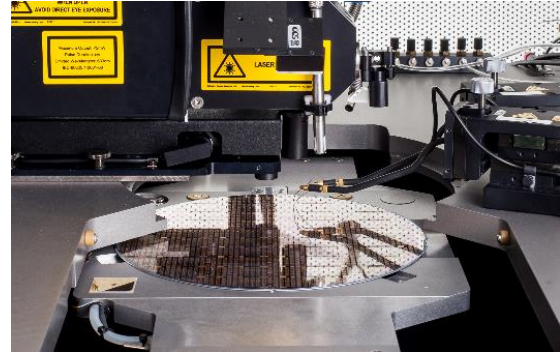


Due to the differential measurement principle the influence of sample bending is eliminated, which is the major obstacle using atomic force microscopes (AFM) for these types of measurements.

# The Method

The principle of the double interferometry was published by N.Setter group at EPFL in 1996. The basic setup only allowed a vertical sample handling. Thus it was useless for industry applications. aixACCT transformed this basic idea into a full automated production tool that is able to handle 8 inch wafer. In addition the systems has an ultrafast acquisition time of a few seconds for a single measurement. Based on a new data acquisition algorithm, the measurement speed is enhanced by a factor of 100.

So it takes only few seconds to derive the  $d_{33}$  parameter with a unique resolution. This enables the tool not only for process optimization but also for production control.



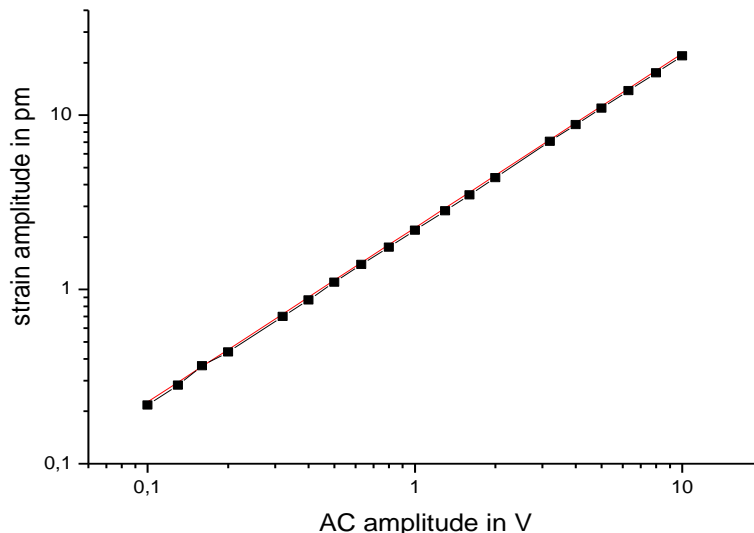
**Double beam laser interferometer setup**

## Unique accuracy

The high resolution and accuracy of the tool is proven by x-cut quartz. The x-cut quartz has a stable and well known piezo coefficient which is linear over the complete voltage range. The graph shows the literature data (red line) and the black line the measured data using the DBLI tool.

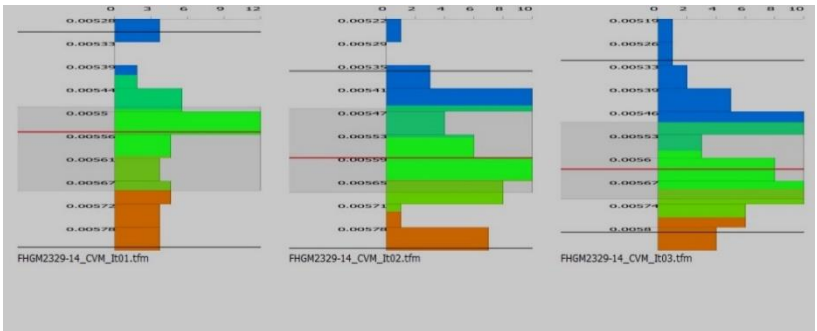
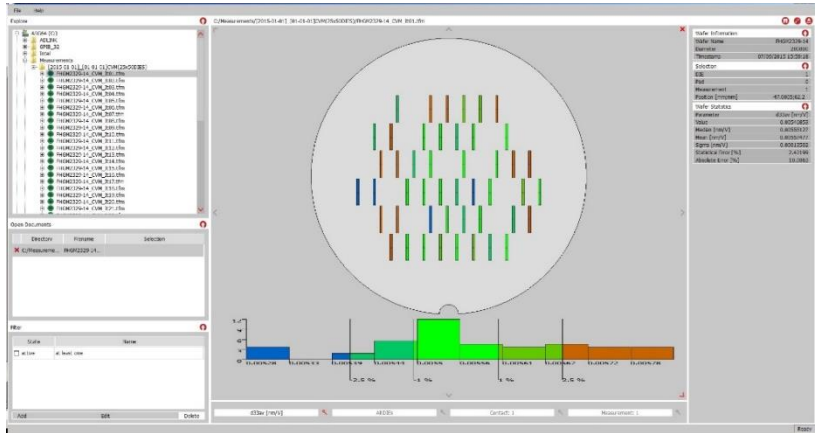
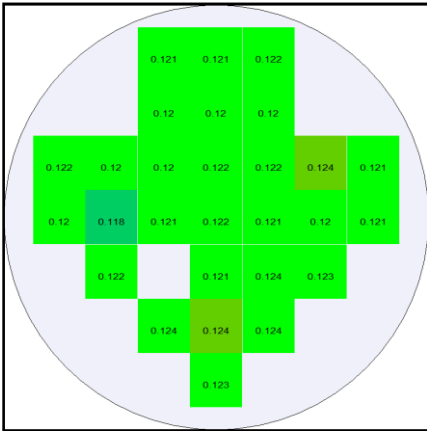
We are able to measure the piezo coefficient of 2.3pm/V with an excitation voltage of 0.1V, which corresponds to a an absolute displacement change of only 230fm!

This ensures a unique reproducibility of the tool. The repeatability is proven by 5 days test during installation.



# aixPERT software

Due to the large amount of parameters that can be measured with the tool like d33Is, d33av, e31Itt, leakage, C(V) etc. it is necessary to have a tool that allows a quick and easy handling of these data. Our aixPERT tool offers statistical evaluation and the visualization of wafer mapping.



## Customer Statements

“With the DBLI technology we were able to optimize our process to 1% homogeneity within six month”

Lead engineer, Seagate Technologies, HDD-Industry, USA

“We use DBLI technology for quality control during production in order to guarantee excellent quality of our coated wafers to our clients!”  
Project Head, Hitachi Cable, Foundry Service, Japan

“The DBLI technology allowed us to distinguish between film reliability issues and device failure.”

Lead Engineer, Seiko EPSON, Printer Industry, Japan

“With aixACCT we have found a reliable partner for characterizations from the prototype to the product. This helps us in our fast and goal-oriented product development”

CTO, USOUND, Andrea Rusconi

# aixACCT

systems

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