



New piezo materials-based energy harvesting MEMS changing the game in several industries

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Silex Microsystems as the leading pure play MEMS foundry is actively collaborating with universities, institutes and commercial partners on a number of development programs aimed at establishing an industrial infrastructure for innovative materials with special focus on thin film nano-technologies. The nano-engineering work has so far been focused on piezoelectric as well as ferromagnetic materials that bring innovative opportunities to design actuators, sensors, RF-MEMS integrated passives, and more. This talk will provide an insight into the different collaborative groups (consortiums), and present the latest achievements in advanced materials development at Silex. As part of the presentation, the following collaborations relevant to nano-technologies will be briefly introduced:

- PZT for RF MEMS actuator structures and IPDs within **EPAMO** ENIAC program
- PZT for energy harvesting as part of European **smart-MEMPHIS**¹ H2020 consortium and Nat'l Vinnova funded Research program **SEHPMET** for innovative ICT
- NiFe/AlN multilayer structures as part of Nat'l Research & Growth program **mag-MEMS**

The talk will present several important nano-material parameters achieved throughout the various programs, as well as achievements with regards to integration with more complex MEMS structures such as released mechanical structures and Through Substrates Via (TSVs) interconnects.

Silex' industrial standard TSV technologies for 3D integration and WL bonding techniques are key elements for a new generation of MEMS devices for Energy Harvesting and Miniaturized sensors suited for Wireless Sensor Networks, novel health care applications, and several other industrial IoT applications¹.

With the new optimized nano engineered PZT processes we were able to achieve >75% improved Figure of Merit (FOM) for PEH application, compared to previously qualified PZT solution at Silex². These results will be presented at the conference.

Although no specific customer device can be disclosed during the talk, general technical results will be shared. World-leading results have already been achieved with regards to electrical breakdown levels as well as e_{31} and d_{31} values for the PZT films developed. The current status of piezo-MEMS and nano tech capabilities will be presented and we will provide a glimpse into Silex' future focus areas on materials. Finally, the presentation will describe the measurement and analysis capabilities as well as other equipment which enable Silex to offer a complete manufacturing platform of PZT foundry services to fabless companies.

References:

1. www.smart-MEMPHIS.eu

2. "PZT developments towards high through-put sol-gel deposition with tunable film properties for actuators, sensors and IPD applications in a MEMS foundry production line", T. Ebefors et al, in proceedings of 4th Int. Workshop on Piezoelectric MEMS, Oct 28-29, 2014, Kobe, Japan.

