

Abstract

# Piezoelectric Microsystems: Material Aspects, Devices and Applications <sup>†</sup>

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<sup>†</sup> Presented at the 4th International Electronic Conference on Sensors and Applications (ECSA 2017), 15–30 November 2017; Available online: <https://sciforum.net/conference/ecsa-4>.

Published: 14 November 2017

**Abstract:** My talk is divided into three parts: First, I will give a short introduction to the Institute of Sensor and Actuator Systems, our infrastructure and our expertise in the field of micro- and nanomachined devices and systems. In the second part of my talk, piezoelectric thin films are introduced for MEMS. I will highlight latest results on the electrical, mechanical and piezoelectrical characterization of sputter-deposited aluminium nitride (AlN) including the impact of sputter parameters, film thickness and substrate pre-conditioning. To enhance the moderate piezoelectric coefficients of pure AlN thin films doping with scandium is done leading to an increase of this material parameter up to factor of 4. In a next step, these films are implemented into the fabrication process of cantilever-type MEMS devices. In combination with a tailored electrode design resonators are realized having Q factors up to about 300 in the frequency range of 1-2 MHz in liquids, thus enabling the precise determination of the viscosity and density of fluids. An additional field of application are vibrational energy harvesters, where the benefit of ScAlN compared to AlN is demonstrated. In the third part of the talk energy harvesting at aircrafts is introduced. Due to the ambient conditions during operation a thermoelectric generator is developed providing enough electrical energy to power wireless sensor nodes for structural health monitoring purposes. The basic concept of the energy harvester as well as first results from flight tests are presented.



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