

Master or diploma thesis

Design and optimization of magnetolectric sensors for industrial applications

The detection of lowest magnetic field changes at room temperature is possible by a new type of sensor concept, in which piezoelectric and magnetostrictive thin layers are combined to a magneto-electric, resonant microstructure (Figure 1).

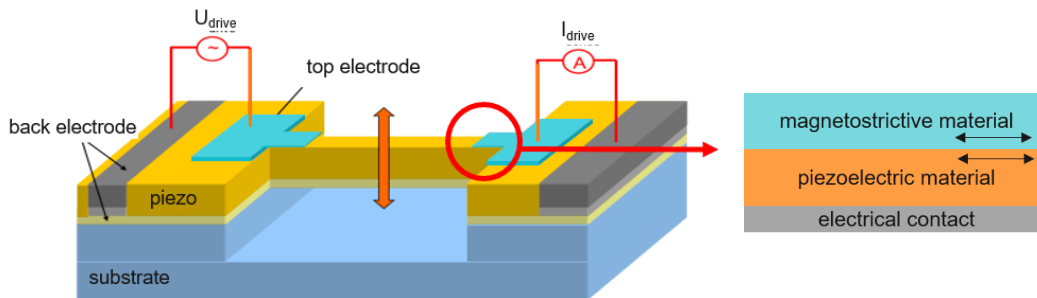


Figure 1: Structure and functional layers of a resonant magnetolectric sensor structure

The function is based on measuring a resonance frequency shift depending on the magnetic field. First sensor structures with resonance frequencies in the lower MHz range have already been realized on the basis of TiN/AlN/Ni (Figure 2,3). The design is now to be optimized for industrial use in order to enable system integration.

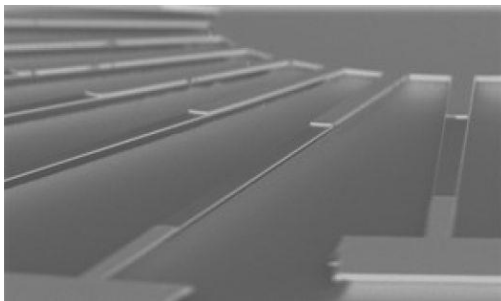


Figure 2: SEM image of a double-sided clamped sensor structure (TiN/AlN/Ni)

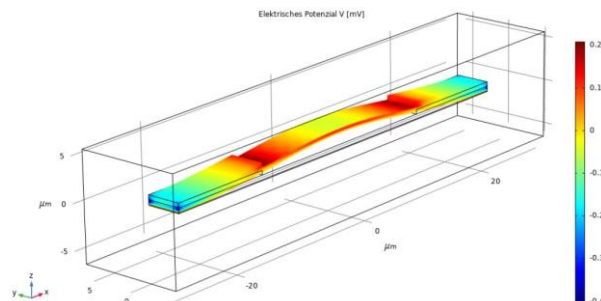


Figure 3: COMSOL simulation model of a sensor structure clamped on both sides with a resonance frequency $f_0 = 2.3$ MHz

Your Task will be to extend the existing COMSOL model in order to include technological functional (e.g. Pt/ScAlN) and auxiliary layers (e.g. Ti), to adjust the size and shape of the structure to a resonance frequency of 30 - 50 kHz and to increase the sensitivity to $\Delta B = 100$ nT. A technological implementation of the thus developed structure in the clean rooms of the ZMN is intended.

The work is affiliated to the **XMEN** research project and takes place in close cooperation with the company **Endress+Hauser AG**. You are invited to take part at the voluntary research group "**Group III-Nitrides**" of the internal graduation college of the Institute for Micro and Nanotechnologies, which aims at a free scientific cooperation.

Language: English or German

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