DocMASE Project Proposal 2011-11

Project Title	***Selectivity Enhancement of Gas Sensitive Field Effect Transistors by Dynamic Operation***
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Project Description	*Gas sensitive field effect transistors based on silicon carbide, SiC-FETs, have been applied to various applications mainly in the area of exhaust and combustion monitoring. So far, these sensors have normally been operated at constant temperatures and adaptations to specific applications have been done by material and transducer platform optimization.* *In this thesis, the methodology of dynamic operation for selectivity enhancement is systematically developed for SiC-FETs. Temperature cycling, which is well known for metal oxide gas sensors, is transferred to SiC-FETs. Additionally, gate bias modulation is introduced increasing the performance further.* *The multi-dimensional sensor data are evaluated by use of pattern recognition mainly based on multivariate statistics. Different strategies for feature selection, cross-validation, and classification methods are studied.* *After developing the methodology of dynamic operation, i.e., applying the virtual multi-sensor approach on SiC-FETs, the concept is validated by two different case studies under laboratory conditions: Discrimination of typical exhaust gases and quantification of nitrogen oxides in a varying background is presented. Additionally, discrimination and quantification of volatile organic compounds in the low parts-per-billion range for indoor air quality applications is demonstrated. The selectivity of SiC-FETs is enhanced further by combining temperature and gate bias cycled operation. Stability is increased by extended training.*