Combined Colorimetric and Gravimetric CMUT Sensor for Detection of Phenylacetone - DTU Orbit (13/12/2018)

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The detection of phenylacetone is of interest as it is a common precursor for the synthesis of (meth)amphetamines. Resonant gravimetric sensors can be used to detect the mass and hereby the concentration of a gas while colorimetric arrays typically have an exceptional selectivity to the target analyte if the right colorimetric dyes are chosen. We present a sensor system consisting of a Capacitive Micromachined Ultrasonic Transducer (CMUT) and a colorimetric array for detection of phenylacetone. The CMUT is used as a resonant gravimetric gas sensor where the resonance frequency shift due to mass loading of the plate. A single Local Oxidation of Silicon (LOCOS) step was used to define the cavities which were sealed with a Si3N4 plate with a thickness of 100nm, resulting in a resonance frequency of 38.8MHz and a theoretical mass sensitivity of 28.3 zg/Hz·μ2. The CMUTs were functionalized with the same dyes used to fabricate colorimetric arrays. While both the CMUTs and the colorimetric arrays showed selectivity to phenylacetone, the best selectivity was achieved by the colorimetric array. Furthermore, the mass of the phenylacetone was found as a function of time. Thus, the combination of the colorimetric array and the CMUT results in a good selectivity and a quantitative value for the mass.

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