High resolution micro-resonators for chemo-selective sensing in liquids

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Fast and selective sensing of drugs or other solutes is a challenge for on-line analytics and control. A novel approach uses hydrogels via a templating procedure for solute specific recognition. A high resolution micro-resonator for mass sensing in liquids is functionalized with chemo-responsive hydrogels to offer a chemo-selective response.

The mass sensor consists of a bridge, whose torsional vibration mode is excited via electromagnetic Lorentz forces. Solely the integrated sensing plate (Ø=5 µm) is wetted by the solution, thus reducing damping. The adsorption of mass on the plate's surface is monitored by the detection of the declining resonator frequency [1]. Functional hydrogels layers can change their mass through specific absorption of a solute or swelling depending on the environmental conditions (pH, ion strength, etc.). The challenge for such applications is the definition of gel micro-structures with UV lithography [2].

In a first approach a pH-sensitive hydrogel was immobilized on a cantilever sensor. Structuring of thin gel layers and the sensor was done simultaneously by reactive ion etching (RIE) using a thin gold or titanium layer as hard mask. In this way high aspect ratio gel microstructures were achieved instead of isotropic structures that are the common output of polymer etching with RIE. The process was technically feasible through continuous passivation of the polymer surface. In a second approach, multiphoton lithographic methods are assessed for structuring of molecular imprinted hydrogels. A detailed discussion on the manufacturing procedure, its actual validation and further developments will be addressed.

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