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Abstract

Conception and Development of Microfabricated Elements for Microfluidic Analytical Devices †

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Portability and low energy consumption are of a great importance for on-site real-time monitoring of indoor air quality. Therefore, this work is focused on the miniaturization of the elements which are the bulkiest and require the highest energy supply in analytical devices. More specifically, micro-fabrication techniques were deployed so that a pre-concentrator and a gas chromatography micro-column with integrated heaters and temperature sensors were developed on silicon wafers of small dimensions of 20 mm × 12 mm and 50 mm × 50 mm, respectively.

Heating elements and sensors were fabricated by thermal evaporation of titanium and gold. In the GC micro-column, four resistances of 82 Ω allow a temperature increase up to 200 °C in 150 s whereas two 430 Ω resistances function as sensors. In the case of the pre-concentrator, three different designs containing heaters of 50–8446 Ω and sensors of 117–555 Ω were proposed in order to investigate the most appropriate configuration to achieve a temperature increase up to 250 °C in 10 s.

Furthermore, a study of wet etching kinetics of Si <100> with KOH (40%) was performed to evaluate its suitability for the fabrication of micro-channels. Silicon etching rates were determined to be between 14.7 and 63.1 μm/h at different temperatures from 50–80 °C. Afterwards, three GC micro-columns of 1, 2 and 3 m in length containing 106 and 146 μm deep microchannels were etched using KOH (40%) at 70 °C, thus demonstrating that wet etching is an alternative and cheaper technique to fabricate micro-columns.

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