

SI-BASED LIQUID SEPARATION MICROSYSTEMS FOR AGROFOOD APPLICATION

A. Benvenuto, L. Lorenzelli*, V. Guarnieri and M. Zen
ITC-irst, Microsystems Division, via Sommarive 18, 38050 Povo(TN), Italy

During the last years, quality and safety in the agro-food field have acquired more and more importance and remarkable interest has been placed in the development of reliable, sensitive, hand-held and low cost instruments for liquid separation. The miniaturization of separation modules by means of silicon-based microfabrication technologies introduces multiple advantages, such as the rapidity of separation, since reduced dimensions imply faster separation process, and the possibility to carry out on-line measurements by means of easy to use and low cost devices [1-2].

In this work the design and simulation results of a Si-based liquid separation microsystem for phenolic compounds detection in wine are presented.

The main modules of the chip are *i.*) a Si-micromachined separation column with inlet and outlet for fluidic connections and *ii.*) a three-electrode amperometric sensor.

Two columns and the related sensors have been designed on the same chip. A system approach has been followed in the chip design in order to optimize the final packaging.

The design of microcolumns geometrical characteristics has been defined in order to optimize column separation efficiency. Finite element analysis of the structure has been performed by using ANSYS tools and the results have been compared with the analytical calculations.

The three-electrode amperometric sensors consist of two Pt electrodes (working and counter) and an Ag/AgCl electrode (reference). The distance of the sensor from the outlet has been chosen in order to minimize dead volumes and according to technological constraints.

In order to operate at 40 °C (typical working temperature of liquid separation systems) a Pt heater has been designed on the back of the column. The geometrical characteristics of the heater have been calculated by considering a dissipated power $P = 100$ mW and a bias voltage $V = 5V$.

Preliminary test structures have been developed by implementing a microfabrication technological process, which mainly consists of Silicon anisotropic etching with TMAH solution, room temperature deep reactive ion etching (DRIE) and anodic bonding.

Future work will be devoted to microcolumn functionalization for phenolic compounds measurement in wine.

REFERENCES

1. P. G. Vahey, S. Park, et al. *Talanta*, 51 (2000)1205
2. M. M. Mc Enery, A. Tan, J. Alderman, J. Patterson, S. C. O'Mathuna and J. D. Glennon, *Analyst*, 125 (2000), 25.

* **CORRESPONDING AUTHOR:** E-mail: lorenzeli@itc.it, Ph: +39 0461314455, Fax: +39 0461302591