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Gas chromatography based on Micro Electro Mechanical Systems (MEMS)

Leïla Bouchra (1), Cyril Szopa (1), Arnaud Buch (2), Pascal Cardinael (3), Valérie Peulon-Agasse (3), David Coscia (1), Jean-Pierre Pineau (1), Vincent Guerrini (1), and Tarik Bourouina (4)

(1) LATMOS, Université Versailles St-Quentin, 11 Blvd. d'Alembert, 78280 Guyancourt, France, (2) LGPM, Ecole Centrale Paris, Grande voie des vignes, 92295 Chatenay-Malabry, France, (3) Laboratiore SMS, Université de Rouen Normandie, Place Emile Blondel, 76821 Mont Saint Aignan, France, (4) ESIEE Paris, 2 boulevard Blaise Pascal, 93162 Noisy-le-Grand, France

Abstract Title

Gas chromatography based on Micro Electro Mechanical Systems (MEMS) for in situ space exploration of planetary environments: first development

Abstract Text

For more than 40 years, gas chromatography (GC) is used in space exploration for analysing the chemical composition of planetary environments in situ. It has been shown to be efficient for measuring the composition of volatile compounds present in planetary atmospheres (e.g. Venera and Pioneer missions to Venus) or surfaces (e.g. Viking and Mars Science Laboratory mission to Mars). Moreover, this instrumentation has a strong potential to help for seeking organic material of interest for astrobiology, and in particular organic molecules that could be related to a prebiotic chemistry or the emergence of life. However, through time, space missions are more and more constraining for instruments in terms of resources available (e.g. energy, mass). Moreover, small scientific payloads should be used in the future in order to send micro probes in planetary environments at a low cost, or in environments difficult from access today for a regular space probes (e.g. Icy satellites). For these reasons, and as GC is a chemical analyser of high interest for planetary sciences, our team started the development of an ultra-miniaturized gas chromatograph for space application using the Micro Electro Mechanical System technology that emerges today on Earth thanks to the progresses made in the fluidic MEMS. With this aim, we started studying and adapting to space instrumentation different MEMS components capable to reproduce the three main functionalities of a GC instrument, i.e. injection, separation, and detection. From this first set of components, we developed a prototype of MEMS GC in order to learn more about the integration of this type of components, and to obtain a first estimation of the performances of such a system. We showed through this work that the system operates well and that the performances obtained are correct from an analytical point of view. We present in this contribution, the main results of this work that we continue to strengthen the hardware and to improve its analytical performances.