IAF SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)

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MEMS BASED MASS SPECTROMETER

Abstract

Mass spectrometers are one of the most versatile analytical instruments, allowing for extensive, fast and sensitive analysis of various types of samples, giving the exact information about its composition. This feature makes them essential tools used for a wide range of applications, including space exploration. However the latest research issues and trends related to this field require the development of a new type of analytical instruments which meet the requirement of minimal size and weight, high sensitivity and resolving power. There is a strong need for miniaturized instrumentation for planned and future space missions based on small (micro- and nano-) spacecraft. Our work on compact high vacuum microsystems resulted in the development of a new type of extremely compact mass spectrometer composed of MEMS-based core components. Works, financed by European Space Agency, strives to develop first of this kind instrumentation, 1U in size (including all the accompanying electronics), while the core component responsible for the analysis (ion source, mass analyzer and detector) are packed together within coherent chip-scale microdevice with weight less than 50 grams and occupying few cubic centimeters. Current results show that it is able to achieve the mass range of between 1 and 350 amu and single unit resolution for the majority of this range. Proposed mass spectrometer could be used in the analysis of the gas composition of various celestial bodies, including Mars, Venus or Moon, resulting in creation of applications which were not available so far, especially for Mars helicopter-based missions and trace gases analysis.