

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

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SPACECRAFT CONTAMINATION CONTROL CHALLENGES FOR SPACE MISSIONS WITH
ORGANIC COMPOUND DETECTION CAPABILITIES AND FOR POTENTIAL SAMPLE RETURN

Abstract

Spacecraft contamination control is critical to space missions with organic compound detection capabilities and for potential sample return. Significant challenges are being addressed and resolved in the design of current and conceptual JPL missions to Mars (Mars 2020), Europa, Enceladus, Titan and Comets in our solar system.

The design, assembly, test and operation of spacecraft with low levels of contamination is fundamental to ensure that organic compounds of terrestrial or self-induced origin are controlled to ensure science objectives are met.

This paper identifies challenges in spacecraft contamination control in the areas of materials outgassing (materials selection, outgassing testing and thermal-vacuum processing), particulates (characterization, control and cleaning), plume induced effects (contamination of spacecraft instruments, landing and sampling sites), molecular and particulate contamination transport and the associated interactions with local atmospheres and plumes.

A discussion of specific mitigation options such as the use of low energy coatings and molecular adsorbers is also presented.

Specific areas of applicability to spacecraft instruments are also addressed: cross-contamination of instruments, highly sensitive mass spectrometers, Raman spectroscopy (fluorescence issues), and optical systems operating in the visible, ultraviolet and infrared wavelengths.