January 1967

Brief 67-10012

NASA TECH BRIEF

Crystal Microbalance Measures Condensable Molecular Fluxes

The problem:

Research in spacecraft surface-effect phenomena, requires the quantitative measurement of molecular fluxes emanating from and condensing on spacecraft surfaces. Conventional ionization mass spectrometry provides excellent qualitative information but poor quantitative data.

The solution:

A quartz crystal vibrating in a thickness shear mode is frequency sensitive to changes in mass on its surface and can be used to measure a fractional monolayer of a condensate. A 28 MH_Z quartz crystal cut at 40°28′ will operate at its zero temperature coefficient at 4°K.

How it's done:

The crystal is mounted on an LH_e-cooled holder inside a molecular sink simulator vacuum chamber to allow the continuous measurement of any molecular flux (except H_e and H_2) emanating from the spacecraft. The natural frequency of this crystal may be measured with an electronic counter and analog and digitally recorded.

Control of the crystal temperature to within a few thousandths of a degree allows sensitivities as great as 1×10^{-10} gm/cm^2 to be achieved. Combining data from crystals operating at various temperatures and from a monopole mass spectrometer provides previously unattainable information about the interaction of molecular fluxes with spacecraft surfaces.

Note:

Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103
Reference: B67-10012

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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(JPL-845)

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