

Recent Results from Curiosity's SAM Instrument at Gale Crater and Looking Ahead to MAVEN

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NASA/GSFC

The Sample Analysis at Mars (SAM) Instrument Suite is presently operating on board the Mars Science Laboratory Curiosity rover. SAM is a mass spectrometer with tunable laser spectrometer equipped with high temperature pyrolysis for evolved gas analysis and gas chromatography. SAM is capable of highly sensitive atmospheric and solid sample investigations emphasizing atmospheric constituents, key isotopic abundances, and the search for Martian organics. At the core of SAM is a highly sensitive quadrupole mass spectrometer with unit mass resolution over the mass range of 2-535 Da. Direct atmospheric measurements are done by direct inlet into the electron ionization source, or through an enrichment front-end employing cooled adsorbents. A sample manipulation system accepts regolith or drilled rock powders delivered by Curiosity's arm. The sample is accepted into one of 72 sample cups that can be heated by pyrolysis capable of reaching 1100°C. In evolved gas analysis mode, delivering volatiles directly to the QMS, the pyrolysis experiment provides characteristic decomposition temperatures for major and minor mineral phases and the release of volatiles entrained in the rock and regolith. Six chromatography analytical columns are present, each with a dedicated thermal conductivity detector. GCMS analyses can provide highly detailed information about the organic content of delivered samples. The TLS can accept atmospheric samples or pyrolysis-evolved gases for precise abundance measurements and isotope ratios for key carbon-containing gases, such as CO₂ and CH₄. Since landing at Gale Crater on August 6, 2012, SAM has conducted a series of atmospheric and solid sample analyses, providing new understanding about the composition of the Martian atmosphere, surface, and near-subsurface. The development of SAM at Goddard Space Flight Center will be discussed, and recent results from the surface investigations at Mars will be presented. An overview of the Neutral Gas and Ion Mass Spectrometer for MAVEN will also be given.