

Detection of spacecraft cabin air contaminants using infrared laser-based methods*

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ABSTRACT

A family of infrared laser-based spectroscopic detection techniques is discussed which can be used for sensitive real-time measurement of air contaminants in a spacecraft cabin environment. In particular, detection of absorption in the 3 - 5 μm region generating the IR by frequency mixing of diode lasers is addressed. Recent experimental data on detection of the ambient CO, N₂O, CH₄, and CO₂ with the use of commercial diode and diode-pumped solid state lasers and new nonlinear optical mixing materials are presented. The detection limits are discussed and compared to those obtained using other techniques. Compact, efficient and rugged automatic sensors can be designed which monitor air quality *in-situ* using a combination of near-IR overtone detection, and mid-IR detection using frequency mixing. Further development of room-temperature or thermoelectrically cooled antimonide diode lasers in the 3 to 5 μm region may permit simpler and more sensitive detection and a more robust sensor design.

*Supported in part by the National Aeronautics and Space Administration, Office of Naval Research, National Science Foundation, and Robert A. Welch Foundation.