FT-IR MEASUREMENTS OF CROSSSECTIONS FOR TRANS-2-BUTENE IN THE 7-15 μM REGION AT 160-297 K FOR TITAN'S ATMOSPHERE

BRENDAN STEFFENS, *Space Sciences, Florida Institute of Technology, Melbourne, FL, USA*; KEEYOON SUNG, MICHAEL MALASKA, ROSALY M LOPES, *Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA*; CONOR A NIXON, *Planetary Systems Laboratory, NASA Goddard Space Flight Center, Baltimore, MD, USA*.

We present temperature-dependent cross sections for $trans$-2-Butene ($trans$-2-C_4H_8: CH_3-CH=CH-CH_3) in the 7 - 15 μm region in support of remote sensing of Titan's stratosphere. It is one of many C_4-hydrocarbons predicted to be in detectable abundances in Titan's atmosphere by photochemical models, but no high-resolution spectroscopy is available in the public databases in the mid-infrared region, let alone at cold temperatures appropriate for Titan.

We collected 28 pure and N_2-mixture spectra and their corresponding background spectra at temperatures between 160-297 K using a Fourier transform spectrometer (Bruker IFS-125HR) at the Jet Propulsion Laboratory at spectral resolutions between 0.0039 and 0.062 cm^{-1}, depending on sample pressures in consideration of line shape resolving power. We obtained transmission spectra by ratioing the sample spectra to their empty-cell spectra, from which several fundamental modes of vibration were identified and updated in comparison to their band centers reported in the literature. We defined two distinct spectral regions, each of which contains multiple vibrational bands and hot band features and we measured the temperature-dependent cross sections, and report their integrated cross sections as well. We performed a separate linearity test between the sample absorbance and optical burden for the spectra obtained at various sample pressures. No significant dependence on temperature was observed in the integrated cross sections, which validated our measurements and methodology. Our measured cross sections will provide critical laboratory input toward a search for $trans$-2-Butene in Titan stratosphere that may be captured in the Cassini/CIRS spectra. To facilitate this, we will report our final results to the public databases, such as HITRAN and GEISA.[a]

[a]Government support acknowledged.