Laboratory spectra of mixtures of CH_4, C_2H6, and CH_3OH

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Abstract

1. Introduction

Infrared spectroscopy is commonly used as a tool for identifying the composition of objects in the Solar System and beyond. Using laboratory spectra, optical constants can be calculated and used to create model spectra for comparison to spectra obtained from infrared telescopes. In this study, the optical constants of mixtures of simple organics, including CH_4, C_2H_6, and CH_3OH were calculated from 15 to 70 K, in the frequency range of 9000-500 cm^{-1} (1.1-20 μm), at a spectral resolution of 1 cm^{-1}.

2. Figures

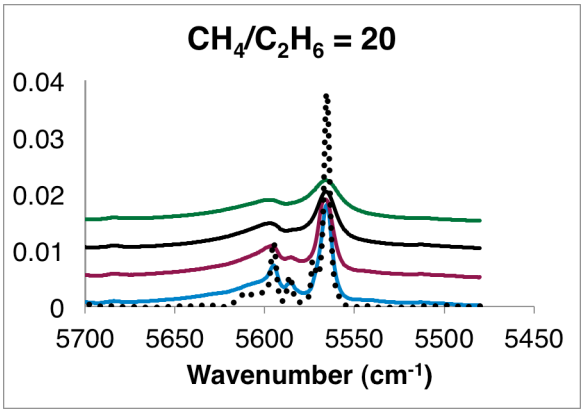

Figure 1. Infrared absorbance spectrum of 1:20 mixture of CH_4:C_2H_6. The peaks near 5565 cm^{-1} and 5595 cm^{-1} are CH_4 absorptions that broaden when C_2H_6 is in the sample matrix. The dotted black line is the spectrum of pure CH_4 at 15K.

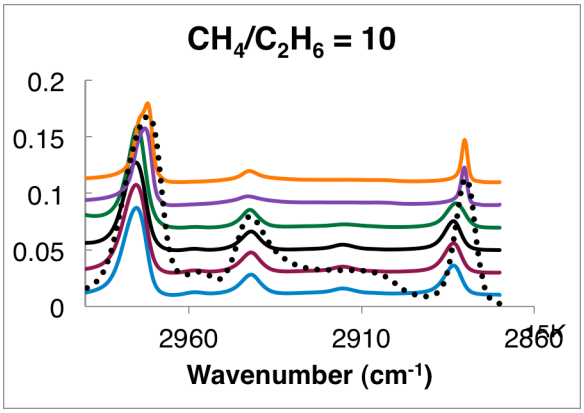

Figure 2. Infrared absorbance spectrum of 1:10 mixture of CH_4:C_2H_6. The peaks at 2880 and 2975 cm^{-1} are C_2H_6 features that shift and broaden when CH_4 is in the sample matrix. The dotted black line is the spectrum of pure C_2H_6 at 15K.

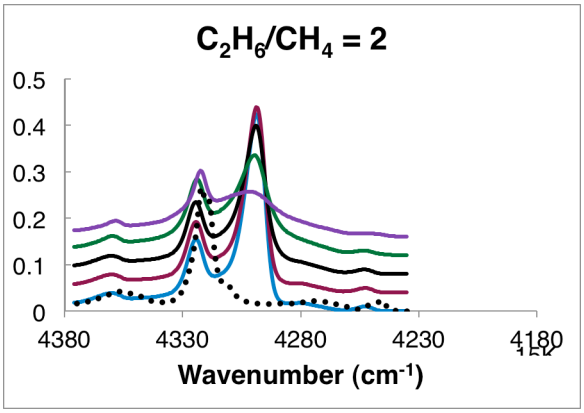

Figure 3. Infrared absorbance spectrum of 2:1 mixture of C_2H_6:CH_4. The CH_4 peak at 4300 cm^{-1} is predominant at lower temperatures, but at 50K after CH_4 has sublimed, the C_2H_6 peak at 4325 cm^{-1} is predominant. The dotted black line is pure C_2H_6 at 15K.

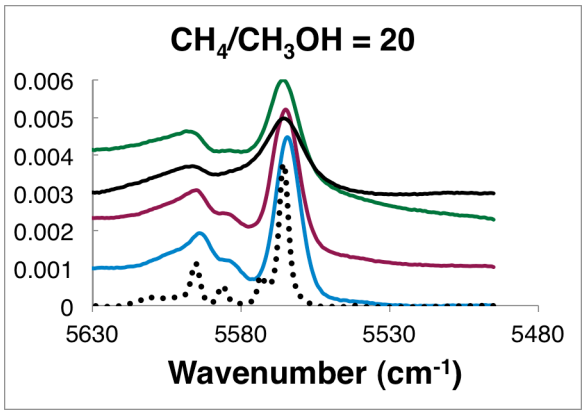

Figure 4. Infrared absorbance spectrum of 20:1 mixture of CH_4:CH_3OH. The CH_4 peaks at 5565, 5585, and 5575 cm^{-1} are shifted and broadened significantly when CH_3OH is in the sample matrix. The dotted black line is the spectrum of pure CH_4 at 15K.

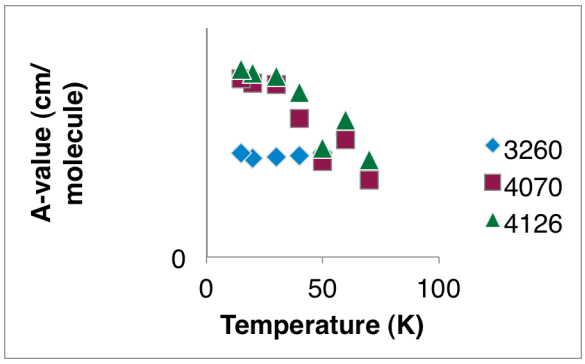

Figure 5. A-values as a function of temperature for the 3260, 4070, and 4126 cm^{-1} peaks in 10:1 mixture of CH_4:C_2H4. Summary and Conclusions

3. Summary and Conclusions

Broadening, weakening, and shifting of spectral bands were analyzed as a function of temperature and composition mixing (ratio). Results of note include significant broadening of the 1300 cm^{-1} and 3000 cm^{-1} peaks, and increased absorbance of the 4600-3800 cm^{-1} peaks with increasing temperature.

Acknowledgements

We would like to thank Monika Kress and Cynthia Phillips, organizers of the Undergraduate Research at the SETI Institute in Astrobiology (URSA) Program. We would also like to thank our friends at NASA Ames: Doug White, Chris Materese, and Michel Nuevo.