



Laboratory spectra of mixtures of CH₄, C₂H₆, and CH₃OH

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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 CH₄, C₂H₆, and CH₃OH were calculated from 15 to 70 K, in the frequency range of 9000-500 cm⁻¹, at a spectral resolution of 1 cm⁻¹.

2. Figures

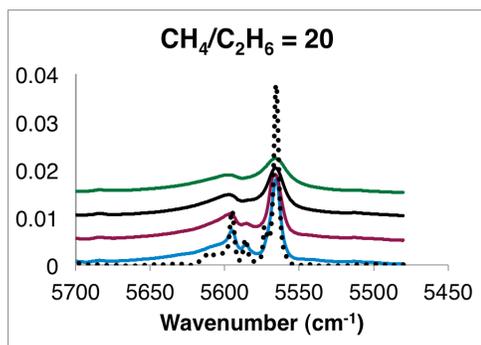


Figure 1. Infrared absorbance spectrum of 1:20 mixture of CH₄:C₂H₆. The peaks near 5565 cm⁻¹ and 5595 cm⁻¹ are CH₄ absorptions that broaden when C₂H₆ is in the sample matrix. The dotted black line is the spectrum of pure CH₄ at 15K.

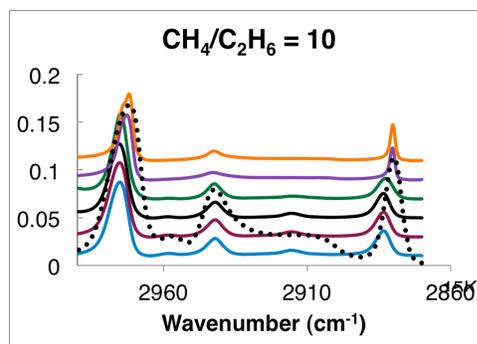


Figure 2. Infrared absorbance spectrum of 1:10 mixture of CH₄:C₂H₆. The peaks at 2880 and 2975 cm⁻¹ are C₂H₆ features that shift and broaden when CH₄ is in the sample matrix. The dotted black line is the spectrum of pure C₂H₆ at 15K.

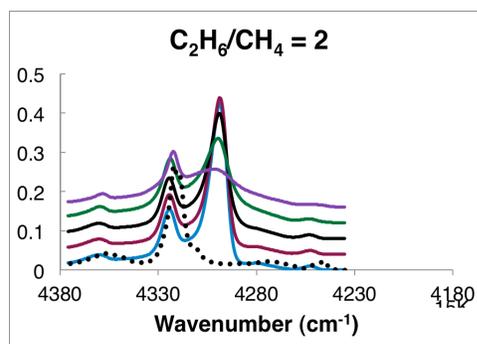


Figure 3. Infrared absorbance spectrum of 2:1 mixture of C₂H₆:CH₄. The CH₄ peak at 4300 cm⁻¹ is predominant at lower temperatures, but at 50K after CH₄ has sublimed, the C₂H₆ peak at 4325 cm⁻¹ is predominant. The dotted black line is pure C₂H₆ at 15K.

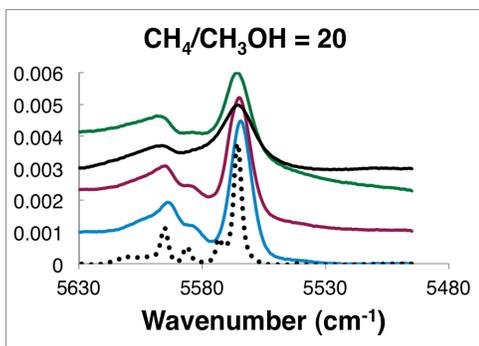


Figure 4. Infrared absorbance spectrum of 20:1 mixture of CH_4 : CH_3OH . The CH_4 peaks at 5565, 5585, and 5575 cm^{-1} are shifted and broadened significantly when CH_3OH is in the sample matrix. The dotted black line is the spectrum of pure CH_4 at 15K.

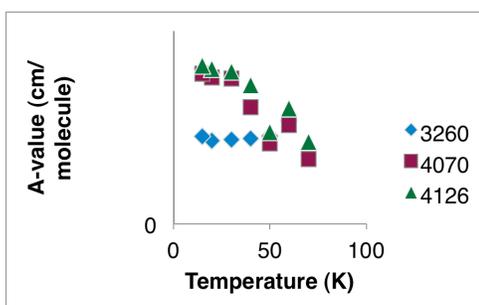


Figure 5. A-values as a function of temperature for the 3260, 4070, and 4126 cm^{-1} peaks in 10:1 mixture of CH_4 : C_2H_4 . Summary and Conclusions

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

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