

# Absorption properties of sulfuric acid in Venus's infrared spectral windows region

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## Abstract

The infrared absorption properties of sulfuric acid have been measured in the spectral range of 1.7 to 2.6  $\mu\text{m}$  at concentration levels appropriate for Venus's clouds.

## 1. Introduction

Venus's clouds, deep atmosphere, and surface can be studied using infrared spectral windows, regions of relative transparency between gaseous molecular absorption bands. Thermal emission emanating from the lower atmosphere and transmitted through the clouds has been observed by ground based telescopes, flyby spacecraft, and extensively by VIRTIS on the orbiting Venus Express spacecraft. Radiation in these windows, particularly the 2.3- $\mu\text{m}$  window, is absorbed by sulfuric acid, with the absorption varying with wavelength, acid concentration, and temperature. Accurate determinations of the optical properties of sulfuric acid are necessary for interpretation of remote cloud observations but there are few measurements of sulfuric acid absorption at concentrations relevant to Venus, and there are regions where there are no measurements. We have measured the imaginary index from 1.7 to  $> 2.6 \mu\text{m}$  for concentrations of 68, 72, 76, 84, 88, 92, and 96 weight-% at 295 K. Since sulfuric acid is extremely hydrophilic, care was taken to ensure against water contamination. We used a transmission cell of known thickness (52  $\mu\text{m}$ ) and accurately determined optical properties. The imaginary indices determined at  $\sim 4\%$  accuracy and are in good agreement with Gosse et al.'s [1] measurement of 72% sulfuric acid and Palmer and Williams [2] 95.6% solution, but are  $\sim 5\%$  greater than for their 75 and 84.5% solutions.

## 2. Figures

The results are shown in Fig. 1 and a comparison to previous measurements are shown in Fig. 2.

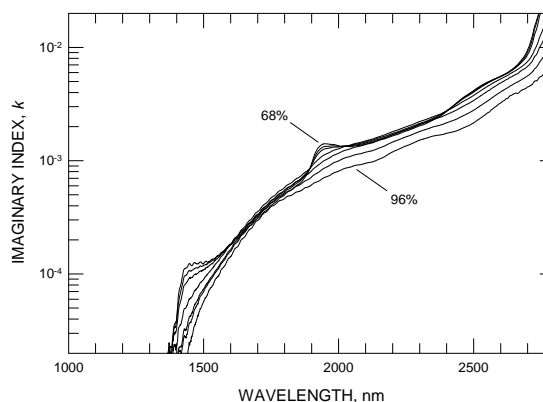


Figure 1: Measured imaginary index for 68, 72, 76, 84, 88, 82, and 96% solutions.

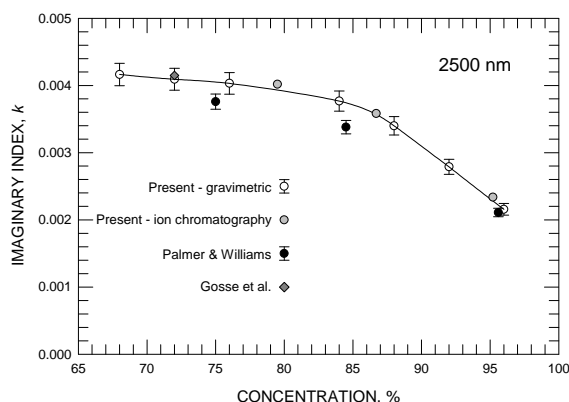


Figure 2. Comparison to prior measurements at 2.5  $\mu\text{m}$

## References

- [1] Gosse, S. F., Wang, M., Labrie, D., and Chylek, P.: Imaginary part of the refractive index of sulfates and nitrates in the 0.7-2.6  $\mu\text{m}$  spectral region, *Appl. Optics*, Vol. 36, pp.3622-3634, 1997.
- [2] Palmer, K. F. and Williams, D.: Optical constants of sulfuric acid: Application to the clouds of Venus?, *Appl. Optics*, Vol. 14, pp. 208-219, 1975.