CCl$_4$ “Matrix Isolation" Spectroscopy of Water and Heavy Water

Introduction

The structure and properties of water, one of the most important hydrogen bonding substances, have been studied extensively. However, opacity due to the large oscillator strength of hydrogen bonds in the liquid makes IR spectroscopy difficult in the 3000-3500 cm$^{-1}$ region. In our work, we use an alternate method for measuring the transmission infrared spectrum of liquid water, heavy water, and ammonia-water solutions, without complications introduced by the optical surface as found in multiple-attenuated total reflectance (ATR) experiments. A great deal of information about the interactions of liquid water with the target solute molecule, NH$_3$ can be deduced by analyzing the hydrogen bonding region of the infrared spectrum. The spectra are acquired by mixing small amounts of water or ammonia-water (on the order of a μL) in an inert, apolar solvent: tetrachloride.
Experimental Set-Up & Results

Glassware and Vacuum Line

The Effect of Silanization

--- un-silanized  silanized

Absorbance (a.u.)

Wavenumber (cm$^{-1}$)