Abstract Submitted and Accepted for COSPAR Meeting in Bremen, Germany (July 18-25, 2010)

Infrared Spectra, Index of Refraction, and Optical Constants of Nitrile Ices Relevant to Titan's Atmosphere

Marla Moore	NASA's Goddard Space Flight Center	Greenbelt, MD
Robert Ferrante	US Naval Academy	Annapolis, MD
William Moore	USRA Goddard Space Flight Center	Greenbelt, MD
Reggie Hudson	NASA's Goddard Space Flight Center	Greenbelt, MD

Abstract

Spectra and optical constants of nitrile ices known or suspected to be in Titan's atmosphere are presented from 2.5 to 200 microns (4000 to 50 cm^{-1}). These results are relevant to the ongoing modeling of Cassini CIRS observations of Titan's winter pole. Ices studied include: HCN, hydrogen cyanide; C_2N_2, cyanogen; CH_3CN, acetonitrile; C_2H_5CN, propionitrile; and HC_3N, cyanoacetylene. For each of these molecules we report new measurements of the index of refraction, n, determined in both the amorphous- and crystalline-phase at 670 nm. Spectra were measured and optical constants were calculated for each nitrile at a variety of temperatures including 20, 35, 50, 75, 95, and 110 K, in the amorphous- and crystalline-phase.

This laboratory effort uses a dedicated FTIR spectrometer to record transmission spectra of thin-film ice samples. Laser interference is used to measure film thickness during condensation onto a transparent cold window attached to the tail section of a closed-cycle helium cryostat. Optical constants, real (n) and imaginary (k) refractive indices, are determined using Kramers-Kronig (K-K) analysis. Our calculation reproduces the complete spectrum, including all interference effects. Index of refraction measurements are made in a separate dedicated FTIR spectrometer where interference deposit fringes are measured using two 670 nm lasers at different angles to the ice substrate.

A survey of these new measurements will be presented along with a discussion of their validation, errors, and application to Titan data.

We acknowledge Mark Loeffler who recently joined in our refractive index measurements. The authors also acknowledge support from the Cassini Data Analysis Program. RLH and MHM acknowledge additional funding from NASA's PG&G and Outer Planets Programs, and the Goddard Center for Astrobiology.

(3/1/2010)