Aerosol Files in HITRAN

Some files in the ascii folder are carried over from previous HITRAN editions. The older files are listed first, followed by the newer files of aerosol indices of refraction. The * symbol in the file name indicates that multiple files (e.g. at several temperatures or weight percent concentrations) are associated with the measurements. If you have any questions, please contact Steven Massie at the Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, Boulder, Colorado (1-303-735-6583, Steven.Massie@lasp.colorado.edu).

File names	Substance
downing_williams_water.dat	Water
kou_water_ice.dat	Water and Ice
afcrl1987_shettle.dat	Water, Ice, Sodium Chloride, Sea Salt, Water Soluble Aerosol, Ammonium Sulfate, Carbonaceous Aerosol, Volcanic Dust, Sulfuric Acid, Meteoric Dust, Quartz, Hematite, Sand, and Dust-like Aerosol
palmer_williams_h2so4.dat	Sulfuric Acid Solutions
remsberg_h2so4_hno3.dat	Sulfuric Acid and Nitric Acid Solutions
steele_hamill_h2so4w.dat	Sulfuric Acid Solutions
timmermans_h2so4rho.dat	Sulfuric Acid Solutions
toon_psc.dat	H_2O -Ice, Amorphous Nitric Acid Solutions, and Nitric Acid Hydrates
norman_hno3_h2o.dat	Aqueous HNO_3/ H_2O
tisdale_h2so4.dat	Sulfuric Acid Solutions
h2so4T*.biermann	Sulfuric Acid Solutions at 12 Temperatures
h2so4T*.niedziela	Sulfuric Acid Solutions at 8 Temperatures
querry_tyler_hno3_h2o.dat	Nitric Acid Solutions
hno3T*.biermann	Nitric Acid Solutions at 7 Temperatures
niedziela_nad.dat	Nitric Acid Dyhydrate (NAD) at 3 Temperatures
richwine_nat.dat	Nitric Acid Trihydrate (NAT)
ice*.clapp	Water Ice at 9 Temperatures
warren_ice.dat	Ice
wagner_supercooled.dat	Supercooled water
myhreh2so4*.dat	H_2SO_4/H_2O Solutions
myhrebin*hno3.dat	HNO_3/H_2O Solutions
myhretern*h2so4*hno3.dat	H_2SO_4/HNO_3/H_2O Solutions
sutherland_khanna_biomass.dat	Organic-based Nonvolatile Aerosols
magi_biomass_fire.dat	Vegetation-fire indices from field measurements
stagg_carbon.dat	Carbon flame at several temperatures
chang_flame_soot.dat	Flame soot
querry_diesel_soot.dat	Diesel soot
alexander_brown_carbon.dat	Brown carbon

organic_acids subdirectory	Organic acids (oxalic, malonic, succinc, pinonic, pyruvic, phthalic)
hasenkopf_organic_haze.dat	Organic haze
zarzana_soa.dat	Secondary organic aerosol proxy
querry_minerals.dat	Minerals (clay, illite, kaolin, montmorillonite)
toon_mont_granite.dat	Minerals (granite, montmorillonite)
wagner_sahara_dust.dat	Sahara dust at several hematite concentrations
sinyuk_saharan_dust.dat	Sahara dust indices from satellite data
grainger_volcanic_ash.dat	Volcanic ash
henning_mutschke_sio2_*.dat	Low temperature SiO_2 (10K – 300 K)
zeidler_sio2_*k*.dat	High temperature SiO_2 (300 K – 928 K; ab, c)
begemann_al2o3_*.dat	Al_2O_3 (porous, compact)
henning_feo.dat	FeO
posch_catio3.dat	$CaTiO_3$ (perovskite)
triaud_fe2o3.dat	Fe_2O_3
jena_fe2sio4.dat	Fe_2SiO_4 (fayalite)
fabian_fe2sio4_*.dat	Fe_2SiO_4 (fayalite; x,y,z)
fabian_mgal2o4_*.dat	$MgAl_2O_4$ (natural and annealed)
jager_mg2sio4.dat	Mg_2SiO_4
jager_mgsio3.dat	$MgSiO_3$
zeidler_tio2_rutile*.dat	TiO_2 (rutile; ordinary, extraordinary)
zeidler_tio2_anatase_*.dat	TIO_2 (anatase; ab, c)
posch_tio2_brookite_*.dat	TiO_2 (brookite; x,y,z)
querry_kcl.dat	KCl
querry_zns.dat	ZnS
khare_tholins.dat	Titan Tholins
ramirez_titan_aerosol.dat	Titan Aerosol

File: **downning_williams_water.dat**

Data: Real and imaginary indices of refraction for water at 27 C between 10 and 5000 cm-1.

Reference: H. D. Downing and D. Williams, "Optical constants of water in the infrared," *J.Geophys.Res.* **80,** 1656-1661 (1975).

File: **kou_water_ice.dat**

Data: Imaginary indices of refraction for water and ice in the 0.67 to 2.5 micron range.

Reference: L. Kou, D. Labrie, and P. Chylek, "Refractive indices of water and ice in the 0.65 to 2.5 micron range," *Appl.Opt.* **32,** 3531-3540 (1993).

File: **afcrl1987_shettle.dat**

Data: Real and imaginary indices of refraction for water, ice, sodium chloride, sea salt, water soluble aerosol, ammonium sulfate, carbonaceous aerosol, volcanic dust, sulfuric acid, meteoric dust, quartz, hematite, sand, and dust-like aerosol. The tabulations start at 0.2 micrometers and extend out to 40 micrometers (or to longer wavelengths).

These indices were used to generate the aerosol models which are incorporated into the LOWTRAN, MODTRAN, and FASCODE computer codes.

Reference: The data were tabulated by E.P. Shettle of the Naval Research Laboratory.

File: **palmer_williams_h2so4.dat**

Data: Real and imaginary indices of refraction of sulfuric acid solutions at 25, 38,50, 75, 84.5,and 95.6% H_2SO_4, by weight.

Reference: K.F. Palmer and D. Williams, "Optical constants of sulfuric acid; Application to the clouds of Venus?" *Appl.Opt.* **14,** 208-219 (1975).

File: **remsberg_h2so4_hno3.dat**

Data: Real and imaginary indices of refraction of sulfuric acid solutions at 75 and 90% H_2SO_4,by weight, plus the standard deviations of the measurements. Real and imaginary indices of refraction of nitric acid solutions at 68% HNO_3, by weight, plus the standard deviations of the measurements.

Reference: E.E. Remsberg, D. Lavery, and B. Crawford, "Optical constants for sulfuric and nitric acids," *J.Chem.Engin.Data* **19,** 263-255 (1974).

File: **steele_hamill_h2so4w.dat**

Data: Theoretical equilibrium composition (weight percentage of H_2SO_4) of sulfuric acid
solutions, given as a function of temperature and H_2O vapour pressure.

Reference: H.M. Steele and P. Hamill, "Effects of temperature and humidity on the growth and optical properties of sulphuric acid-water droplets in the stratosphere," *J.Aerosol Sci.* **12,** 517-528 (1981).

File: **timmermans_h2so4rho.dat**

Data: Sulfuric acid density (gm/cm^3) values for solutions between 0 and 100% H_2SO_4 (by weight) for temperatures between 0 and 60 C.

Reference: J. Timmermans, "The physico-chemical constants of binary systems in concentrated solutions," Interscience, New York, (1960).

The data cited here (from pages 561-562 of Timmermans) are from Domke and Bein (1905).

File: **toon_psc.dat**

Data: Real and imaginary indices of refraction of H_2O-ice, amorphous nitric acid solutions, and nitric acid hydrates.

Reference: O.B. Toon, M.A. Tolbert, B.G. Koehler, A.M. Middlebrook, and J. Jordan, "The infrared optical constants of H_2O-ice, amorphous acid solutions, and nitric acid hydrates," *J.Geophys.Res.* **99,** 25631-25654 (1994).

File: **norman_hno3_h2o.dat**

Data: Real and imaginary indices of aqueous HNO_3/H_2O at 220 K from 754 to 4700 cm^{-1} for 35, 45, 54, 63, and 70% HNO_3 by weight.

Reference: M.L. Norman, J. Qian, R.E. Miller, and D.R. Worsnop, "Infrared complex refractive indices of supercooled liquid HNO_3/ H_2O aerosols," *J.Geophys.Res.* **104,** 30571-30584 (1999).

Email contact person: R.E. Miller (remiller@unc.edu)

File: **tisdale_h2so4.dat**

Data: Real and imaginary indices of liquid H_2SO_4/ H_2O at 215 K from 499 to 6996 cm^{-1} as a function of the H_2SO_4 concentration by weight.

Reference: R.T. Tisdale, D.L. Glandorf, M.A. Tolbert, and O.B. Toon, "Infrared optical constants of low-temperature H_2SO_4 solutions representative of stratospheric sulfate aerosols," *J.Geophys.Res.* **103,** 25353-25370 (1998).

Email contact person: M. Tolbert (tolbert@spot.colorado.edu)

Files: **h2so4T*.biermann**

Data: Real indices of liquid H_2SO_4/ H_2O from 0 to 16382 cm^{-1} and imaginary indices from 432 to 5028 cm^{-1} at 12 temperatures (213 to 293K) as a function of the H_2SO_4 concentration by weight.

Reference: U.M. Biermann, B.P. Luo, and Th. Peter, "Absorption Spectra and Optical Constants of Binary and Ternary Solutions of H_2SO_4, HNO_3, and H_2O in the Mid Infrared at Atmospheric Temperatures," *J.Phys.Chem. A* **104,** 783-793 (2000).

Email contact person: B.P. Luo (luo@mpch-mainz.mog.de)

Files: **h2so4T*.niedziela**

Data: Real and imaginary indices of liquid H_2SO_4/ H_2O at 8 temperatures (200 to 300 K) from 825 to 4700 cm^{-1}.

Reference: R.F. Niedziela, M.L. Norman, C.L. deForest, R.E. Miller, and D.R. Worsnop, "A Temperature and Composition-Dependent Study of H_2SO_4 Aerosol Optical Constants Using Fourier Transform and Tunable Diode Laser Infrared Spectroscopy," *J.Phys.Chem. A* **103,** 8030 8040 (1999).

Email contact person: R.E. Miller (remiller@unc.edu)

File: **querry_tyler_hno3_h2o.dat**

Data: Real and imaginary indices of liquid HNO_3/ at room temperature from 250 to 4987 cm^{-1} as a function of the HNO_3 concentration by weight. The concentrations of 3.1, 6.1, 11.8, 22.3, 40.3, and 70% HNO_3 correspond to the molar (M) concentrations of 0.5, 1.0, 2.0, 4.0, 8.0, and 15.7 cited in the Querry and Tyler paper.

Reference: M.R. Querry and I.L. Tyler, "Reflectance and complex refractive indices in the infrared of aqueous solutions of nitric acid," *J.Chem.Phys.* **72,** 2495-2499 (1980).

Files: **hno3T*.biermann**

Data: Real indices of liquid HNO_3/ H_2O from 0 to 16382 cm^{-1} and imaginary indices from 432 to 5028 cm^{-1} at 7 tempertatures (213 to 293K) as a function of the HNO_3 concentration by weight.

Reference: U.M. Biermann, B.P. Luo, and Th. Peter, "Absorption Spectra and Optical Constants of Binary and Ternary Solutions of H_2SO_4, HNO_3, and H_2O in the Mid Infrared at Atmospheric Temperatures," *J.Phys.Chem. A* **104,** 783-793 (2000).

Email contact person: B.P. Luo (luo@mpch-mainz.mog.de)

Files: **niedziela_nad.dat**

Data: Real and imaginary indices of nitric acid dyhydrate (NAD) at 3 temperatures (160 to 190 K) from 700 to 4700 cm^{-1}.

Reference: R.F. Niedziela, R.E. Miller, and D.R. Worsnop, "Temperature and Frequency- Dependent Optical Constants for Nitric Acid Dihydrate from Aerosol Spectroscopy," *J.Phys.Chem. A* **102,** 6477-6484 (1998).

Email contact person: R.E. Miller (remiller@unc.edu)

File: **richwine_nat.dat**

Data: Real and imaginary refractive indices of nitric acid trihydrate (NAT) at 160 K from 711 to 4004 cm^{-1}.

Reference: L.J. Richwine, M.L. Clapp, R.E. Miller, and D.R. Worsnop, "Complex refractive indices in the infrared of nitric acid trihydrate aerosols," *Geophy.Res.Lett.* **22,** 2625-2628 (1995).

Email contact person: R.E. Miller (remiller@unc.edu)

Files: **ice*.clapp**

Data: Real and imaginary indices of water ice at 9 temperatures (130 to 210 K) from 800 to 4004 cm^{-1}.

Reference: M.L. Clapp, R.E. Miller, and D.R. Worsnop, "Frequency-Dependent Optical Constants of Water Ice Obtained Directly from Aerosol Extinction Spectra," *J.Phys.Chem*. **99,** 6317-6326 (1995).

Email contact person: R.E. Miller (remiller@unc.edu)

File: **warren_ice.dat**

Data: Real and Imaginary indices of Ice Ih at 266 K from 44 nm to 2 m.

Reference: S.G. Warren and R.E. Brandt, "Optical constants of ice from the ultraviolet to the microwave: A revised compilation." *J.Geophys.Res.* **113,** D14220 (2008).

Email contact person: Stephen G. Warren (sgw@atmos.washington.edu)

File: **wagner_supercooled.dat**

Data: Real and imaginary indices of supercooled water at 238, 252, 258, and 269 K from 1101 to 4503 cm^{-1}

Reference: R. Wagner, S. Benz, O. Muhler, H. Saathoff, M. Schnaiter, and U. Schurath, "Mid- Infrared Extinction Spectra and Optical Constants of Supercooled Water Droplets," *J.Phys.Chem.* **109**, 7099-7112 (2005).

Email contact person: Robert Wagner (Robert.Wagner@imk.fzk.de)

Files: **myhreh2so4*.dat**

Data: Real and imaginary indices of H_2SO_4/H_2O droplets at 0.81, 0.81, 0.81, 0.76, 0.76 weight percent H_2SO_4 at 298, 273, 267, 298, 273 K from 1.3 to 25 µm.

Reference: C.E. Lund Myhre, D.H. Christensen, F.M. Nicolaisen, and C.J. Nielsen, "Spectroscopic Study of Aqueous H_2SO_4 at Different Temperatures and Compositions: Variations in Dissociation and Optical Properties," *J.Phys.Chem*. **107**, 1979-1991 (2005).

Email contact person: C.E. Lund Myhre (e.c.lund@iakh.uio.no.)

Files: **myhrebin*hno3.dat**

Data: Real and imaginary indices of binary HNO_3/H_2O at 223, 233, 243, 253, 273 and 293 K from 450 to 6500 cm^{-1} 30% HNO_3, 70% H_2O from 1.5 to 22 µm.

Reference: C.E. Lund Myhre, H. Grothe, A.A. Gola, and C.J. Nielsen, "Optical Constants of HNO_3/H_2O and $H_2SO_4/HNO_3/H_2O$ at Low Temperatures in the Infrared Region," *J.Phys.Chem*. **109**, 7166-7171 (2005).

Email contact person: C.J. Nielsen (c.j.nielsen@kjemi.uio.no.)

Files: **myhretern*h2so4*hno3.dat**

Data: Real and imaginary indices of ternary droplets at 203, 213, 223, 253, 273 and 293 K from 450 to 6500 cm^{-1} 23% HNO_3, 21% H_2SO_4, 56% H_2O from 1.5 to 22 µm.

Reference: C.E. Lund Myhre, H. Grothe, A.A. Gola, and C.J. Nielsen, "Optical Constants of HNO_3/H_2O and $H_2SO_4/HNO_3/H_2O$ at Low Temperatures in the Infrared Region," *J.Phys.Chem*. **109**, 7166-7171 (2005).

Email contact person: C.J. Nielsen (c.j.nielsen@kjemi.uio.no.)

File: **sutherland_khanna_biomass.dat**

Data: Real and imaginary refractive indices of organic-based nonvolatile aerosols produced by burning vegetation from 525 to 5000 cm^{-1}. The mixed weed sample indices of Table 2 from the paper by Sutherland and Khanna are tabulated here.

Reference: R.A. Sutherland and R.K. Khanna, "Optical Properties of Organic-based Aerosols Produced by Burning Vegetation," *Aerosol Science and Technology* **14,** 331-342 (1991).

File: **magi_biomass_fire.dat**

Data: Real and imaginary indices of biomass burning aerosol retrieved from SAFARI field campaign data, from 354 - 1557 nm

Reference: B. J. Magi, Q. Fu, and Redemann, A methodology to retrieve self-consistent aerosol properties using common aircraft measurements *J. Geophys. Res*., **112**, D24S12, doi:10.1029/2006JD008312, 2007

File: **stagg_carbon.dat**

Data: Real and imaginary indices of refraction of pyrolytic graphite, amorphous carbon, propane and flame soot 400 to 700 nm

Reference: B. J. Stagg and T. T. Charalampopoulis, Refraction Indices of Pyrolytic Graphite, Amorphous Carbon, and Flame Soot in the Temperature Range 25 to 600C, *Combustion and Flame*, **94**:381-396, 1993.

File: **chang_flame_soot.dat**

Data: Real and imaginary indices of refraction of flame soot from 0.20 to 38.4 microns at three heights (in mm) above the flame

Reference: H. Chang and T. T. Charalampopoulis, Determination of the Wavelength Dependence of Refractive Indices of Flame Soot **Proc. R. Soc. London A** 1990, **430**, 577-591, doi:10.198/rspa.1990.0107

File: **querry_diesel_soot.dat**

Data: Real and imaginary indices of refraction of Diesel Soot.

Reference: Marvin R. Querry, Optical Constants of Minerals and Other Materials FromThe Millimeter To The Ultraviolet CRDEC-CR-88009, November 1987.

File: **alexander_brown_carbon.dat**

Data: Real and imaginary indices of brown carbon spheres measured during the Asian Pacific Regional Aerosol Characterization Experiment (ACE-Asia). Complex dielectric constants are also tabulated.

Reference: Duncan. T. Alexander, Peter A. Crozier, James R. Anderson, Brown Carbon Spheres in East Asian Outflow and Their Optical Properties, *Science*, **321**, 8, August 2008.

Email contact person: Peter Crozier (crozier@asu.edu).

File: **organic_acids subdirectory**

Data: Imaginary indices of Organic acids (oxalic, malonic, succinc, pinonic, pyruvic, phthalic) at 293K from 0.25 to 1.1 microns.

Reference: C.E. Lund Myhre and C.J. Nielsen, Optical properties in the UV and visible spectral region of organic acids relevant to tropospheric aerosols, *Atmos. Chem. Phys*., **4**, 1759-1769, 2004.

Email contact person: C. J. Nielsen (claus.nielsen@kjemi.uio.no)

File: **hasenkopf_organic_haze.dat**

Data: Real and imaginary indices at 532 nm of organic haze for Titan and early Earth, and other determinations.

Reference: C. Hasenkopf, M. Beaver, M. Trainer, H. Dewit, M. Freedman, O. Toon, C. McKay, M. Tolbert, Optical properties of Titan and early earth haze laboratory analogs in the mid-visible, *Icarus*, **207**, 903-913, 2010.

Email contact person: Christa Hasenkopf (Christa.Hasenkopf@colorado.edu)

File: **zarzana_soa.dat**

Data: Real and imaginary indices at 532 nm of proxies of secondary organic aerosol, and other determinations of HULIS indices

Reference: Kyle J. Zarzana, David O. DeHaan, Miriam A. Freedman, Christa A. Hasenkopf, and Margaret A. Tolbert. Optical Propertiers of the Products of alpha-Dicarbonyl and Amine Reactions in Simulated Cloud Droplets, *Env Sci Tech*,**46**,4845-4851,2012.

Email contact person: Kyle Zarzana (kyle.zarzana@colorado.edu)

File: **querry_minerals.dat**

Data: Real and imaginary indices of refraction of materials from 2.5 to 50 microns. This listing focuses upon various minerals (clay, illite, kaolin, montmorillonite).

Reference: Marvin R. Querry, Optical Constants of Minerals and Other Materials From The Millimeter To The Ultraviolet CRDEC-CR-88009, November 1987.

Email contact person: Steven Massie (Steven.Massie@lasp.colorado.edu)

File: **toon_mont_granite.dat**

Data: Real and imaginary indices of Montmorillonite and Granite from 250 to 2000 cm-1.

Reference: Toon, O. B., J. B. Pollack, C. Sagan, Physical Properties of the Particles Composing the Martian Dust Storm of 1971 – 1972, *Icarus*, **30**, 663-696, 1977

Email contact person: Brian Toon, btoon@lasp.colorado.edu

File: **wagner_sahara_dust.dat**

Data: Imaginary indices of Saharan dust samples for five locations with hematite between 1 and 3 % by volume for 305 - 955 nm.

Reference: R. Wagner, T. Ajtai, K. Kandler, K. Lieke, C. Linke, T. Muller, M. Schnaiter, and N. Vragel. Complex refractive indices of Saharan dust samples at visible and near UV wavelengths: a laboratory study. *Atmos. Chem. Phys*., **12**, 2491-2512, 2012.

Email contact person: R. Wagner (robert.wagner2@kit.edu)

File: **sinyuk_saharan_dust.dat**

Data: Imaginary indices of Saharan dust derived from TOMS data for 350 - 650 nm. Also include Patterson (1977) data in file.

Reference: Alexander Sinyuk, Omar Torres, and Oleg Dubovik, Combined us of satellite and surface observations to infer the imaginary part of refractive index of Saharan dust, *Geophys. Res. Lett*., **30**,no 2,1081, doi:10.1029/2002GL016189, 2003

Email contact person: Steven Massie (Steven.Massie@lasp.colorado.edu)

File: **grainger_volcanic_ash.dat**

Data: Ash volcanic refractive indices from 1 to 20 microns.

Reference: Grainger, R. G., Peters, D. M., Thomas, G. E., Smith, A. J. A., Siddans, R., Carboni, E., and Dudhia, A.: Measuring Volcanic Plume and Ash Properties from Space, in: Remote Sensing of Volcanoes and Volcanic Processes: Integrating Observation and Modelling, edited by Pyle, D. and Mather, T., vol. 270 of Special Publications, Geological Society, London, 2012.

Email contact person: R. G. Grainger (R.Grainger@physics.ox.ac.uk)

File: **henning_mutschke_sio2_*.dat**

Data: Real and Imaginary Refractive Indices of amorphous SiO_2 at 10, 100, 200, 300 K.

Reference: Henning, T. and H. Mutschke, Low Temperture infrared properties of cosmic dust analogues, *Astronomy and Astrophysics*, **327**, p743-754, 1997

Email contact person: Thomas Henning (henning@mpia.de)

File: **zeidler_sio2_*k*.dat**

Data: Real and Imaginary Refractive Indices of crystalline SiO_2 at 300, 551, 738, 833 K.

Reference: Zeidler, S., Th. Posch, and H. Mutschke, Optical constants of refractory oxides at high temperatures Mid-infrared properties of corundum, spinel, and alpha-quartz, *Astronomy and Astrophysics*, **553**, A81, 2013.

Email contacts: Simon Zeidler (simon.zeidler@nao.ac.jp) and H. Mutschke (harald.mutschke@uni-jena.de)

File: **begemann_al2o3_*.dat**

Data: Real and Imaginary Refractive Indices of compact and porous Al_2O_3.

Reference: Begemann, B., J. Dorschner, Th. Henning, H. Mutschke, J. Gurtler, C. Kompe, and R. Nass, Aluminum oxide and the opacity of oxygen-rich circumstellar dust in the 12-17 micron range, *Astrophysical Journal*, **476**, 199-208, 1997.

Email contact person: H. Mutschke (harald.mutschke@uni-jena.de)

File: **henning_feo.dat**

Data: Real and Imaginary Refractive Indices of FeO.

Reference: Henning, Th., B. Begemann, H. Mutschke, J. Dorschner, Optical properties of oxide dust grains, *Astronomy and Astrophysics*, *Supplement Series*, **112**, 143-149, 1995.

Email contact person: Thomas Henning (henning@mpia.de)

File: **posch_catio3.dat**

Data: Real and Imaginary Refractive Indices of $CaTiO_3$ (Perovskite).

Reference: Posch, Th., F. Kerschbaum, D. Fabian, H. Mutschke, J. Dorschner, A. Tamanai, Th. Henning, Infrared Properties of Solid Titanium Oxides: Exploring Potential Primary Dust Condensates *Astrophysical Journal Supplement Series*, *149*, 437-445, 2003.

Email contact person: Thomas Posch (thomas.posch@univie.ac.at)

File: **triaud_fe2o3.dat**

Data: Real and Imaginary Refractive Indices of Fe_2O_3 E || a,b.

Reference: HMJ Triaud (Amaury.Triaud@obs.unige.ch) unpublished data stored at http://www.astro.uni-jena.de/Laboratory/OCDB/mgfeoxides.html#C

Email contact person: Amaury H.M.T Triaud (aht34@ast.cam.ac.uk)

File: **jena_fe2sio4.dat**

Data: Real and Imaginary Refractive Indices of Fe_2SiO_4 (Fayalite).

Reference: unpublished data stored at http://www.astro.uni-jena.de/Laboratory/OCDB/data/silicate /crystalline/fay_vis.txt

Email contact person: H. Mutschke (harald.mutschke@uni-jena.de)

File: **fabian_fe2sio4_*.dat**

Data: Real and Imaginary Refractive Indices of Fe_2SiO_4 (Fayalite).

Reference: Fabian, D., T. Henning, C. Jager, H. Mutschke, J. Dorschner and O. Wehrhan, Steps toward interstellar silicate mineralogy VI. Dependence of crystalline olivine IR spectra on iron content and particle shape, *Astronomy and Astrophysics*, **378**, 228-238, 2001.

Email contact person: H. Mutschke (harald.mutschke@uni-jena.de)

File: **fabian_mgal2o4_*.dat**

Data: Real and Imaginary Refractive Indices of Annealed $MgAl_2O_4$.

Reference: Fabian, D., Th. Posch, H. Mutschke, F. Kerschbaum, and J. Dorschner, Infrared optical properties of spinels, A study of the carrier of the 13, 17 and 32 micron emission features observed in ISO-SWS spectra of oxygen-rich AGB stars, *Astronomy and Astrophysics*, **373**, 1125-1138, 2001.

Email contact person: H. Mutschke (harald.mutschke@uni-jena.de)

File: **jager_mg2sio4.dat**

Data: Real and Imaginary Refractive Indices of Mg_2SiO_4.

Reference: Jager, C., J. Dorschner, H. Mutschke, Th. Posch, Th. Henning, Steps toward interstellar silicate mineralogy VII. Spectral properties and crystallization behaviour of magnesium silicates produced by the sol-gel method, *Astronomy and Astrophysics*, **408,** 193-204, 2003.

Email contact person: Cornelia Jaeger (cornelia.jaeger@uni-jena.de)

File: **jager_mgsio3.dat**

Data: Real and Imaginary Refractive Indices of $MgSiO_3$.

Reference: Jager, C., J. Dorschner, H. Mutschke, Th. Posch, Th. Henning, Steps toward interstellar silicate mineralogy VII. Spectral properties and crystallization behaviour of magnesium silicates produced by the sol-gel method, *Astronomy and Astrophysics*, **408**, 193-204, 2003.

Email contact person: Cornelia Jaeger (cornelia.jaeger@uni-jena.de)

File: **zeidler_tio2_rutile*.dat**

Data: Real and Imaginary Refractive Indices of TiO_2 (Rutile; Ordinary and Extraordinary).

Reference: Zeidler, S., T. Posch, H. Mutschke, H. Richter, O. Wehrhan, Near-infrared absorption properties of oxygen-rich stardust analogs, The influence of coloring metal ions, *Astronomy and Astrophysics*, **526,** article 68, 1-10, 2011.

Email contacts: Simon Zeidler (simon.zeidler@nao.ac.jp) and H. Mutschke (harald.mutschke@uni-jena.de)

File: **zeidler_tio2_anatase_*.dat**

Data: Real and Imaginary Refractive Indices of TiO_2 (Anatase; ab, c).

Reference: Zeidler, S., T. Posch, H. Mutschke, H. Richter, O. Wehrhan, Near-infrared absorption properties of oxygen-rich stardust analogs, The influence of coloring metal ions, *Astronomy and Astrophysics*, **526**, article 68, 1-10, 2011.

Email contacts: Simon Zeidler (simon.zeidler@nao.ac.jp) and H. Mutschke (harald.mutschke@uni-jena.de)

File: **posch_tio2_brookite_*.dat**

Data: Real and Imaginary Refractive Indices of TiO_2 (Brookite; x, y, z).

Reference: Posch, Th., F. Kerschbaum, H. Mutschke, D. Fabian, D. Clément, J. Dorschner, 'Features of oxide dust particles in circumstellar shells of AGB stars', In: Exploiting the ISO Data, p. 14

Email contact person: Thomas Posch (thomas.posch@univie.ac.at)

File: **querry_kcl.dat**

Data: Real and imaginary indices of refraction of KCl.

Reference: Marvin R. Querry, Optical Constants of Minerals and Other Materials From The Millimeter To The Ultraviolet CRDEC-CR-88009, November 1987.

Email contact person: Steven Massie (Steven.Massie@lasp.colorado.edu)

File: **querry_zns.dat**

Data: Real and imaginary indices of refraction of ZnS.

Reference: Marvin R. Querry, Optical Constants of Minerals and Other Materials From The Millimeter To The Ultraviolet CRDEC-CR-88009, November 1987.

Email contact person: Steven Massie (Steven.Massie@lasp.colorado.edu)

File: **khare_tholins.dat**

Data: Real and Imaginary Refractive Indices of Titan Tholins.

Reference: Khare, B. N., C. Sagan, E. T. Arakawa, F. Suits, T. A. Callcott, and M. W. William, Optical Constants of Organic Tholins Produced in a Simulated Titanian Atmosphere: from Soft X-Ray to Microwave Frequencies, *Icarus*, **60**, 127-137, 1984.

Email contact person: Steven Massie (Steven.Massie@lasp.colorado.edu)

File: **ramirez_titan_aerosol.dat**

Data: Real and Imaginary Refractive Indices of Titan Aerosol.

Reference: Ramirez, S. I, P.Coll, A. da Silva, R. Navarro-Gonzalez, J. Lafait, and F. Raulin, Complex Refractive Index of Titan s Aerosol Analogues in the, 200-900 nm Domain, *Icarus*, **14**6, 515-529, 2002.

Email contact person: S. I. Ramirez (ramirez@lisa.univ-paris12.fr)