

Package: dielectric (via r-universe)

October 15, 2024

Maintainer Baptiste Auguie <baptiste.auguie@gmail.com>

License GPL-3

Title Defines some physical constants and dielectric functions commonly used in nano-optics

URL <https://github.com/nano-optics/dielectric>

BugReports <https://github.com/nano-optics/dielectric/issues>

DOI <http://dx.doi.org/10.5281/zenodo.11420>

Type Package

LazyLoad yes

LazyData yes

Description Physical constants. Gold, silver and glass permittivities, together with spline interpolation functions.

Version 0.2.4

Depends R (>= 2.13), methods

Suggests ggplot2

RoxygenNote 7.2.1

Encoding UTF-8

Repository <https://nano-optics.r-universe.dev>

RemoteUrl <https://github.com/nano-optics/dielectric>

RemoteRef HEAD

RemoteSha d191c3a04ab84a295023b5d1e7ce2222343ea378

Contents

AgPalik	2
AlRakic	3
aSi	3
AuJC	4
Chromium	4

clausius_mossotti	5
constants	5
dielectric-class	6
dielectric2plot	6
drude	7
epsAg	8
epsAu	9
eV2L	10
fit_drude	11
L2eV	11
L2w	12
sapphire	13
t2eV	13
Ti	14

Index	15
--------------	-----------

AgPalik

Silver in the visible, from Palik

Description

Dielectric dataset corresponding to the values of Palik.

Usage

AgPalik

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

AlRakic *Aluminium in the visible*

Description

Dielectric dataset corresponding to the values of Rakic.

Usage

AlRakic

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

aSi *Chromium in the visible*

Description

Dielectric dataset

Usage

aSi

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

AuJC

Gold in the visible

Description

Dielectric dataset corresponding to the values of Johnson and Christy

Usage

AuJC

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

Chromium

Chromium in the visible

Description

Dielectric dataset corresponding to the values of Palik

Usage

Chromium

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

clausius_mossotti *clausius_mossotti*

Description

clausius_mossotti

Usage

clausius_mossotti(alpha = 1, N = 0.1)

Arguments

alpha	in nm ³
N	in nm ⁻³

Details

lorentzian polarizability of a molecule

Value

relative dielectric function

Author(s)

baptiste Auguie

constants *Various physical constants*

Description

Constants dataset

Usage

constants

Format

list with names cel h hbar ee eps0 Z0 Nav mu0

dielectric-class *spline*

Description

spline interpolation of permittivity

Arguments

... optional arguments passed to smooth.spline

Details

spline interpolation of permittivity

Value

list

Methods

fun(wavelength, ...) returns a continuous function of the wavelength

permittivity(new.wavelength, ...) predict a single value

predict(sp = NULL, range = span, n = length(epsilon), new.wavelength = NULL, ...) interpolation with splines

raw(range = span) return the raw data as real numbers

spline(...) returns a list of splinefun for the real and imaginary parts

Author(s)

baptiste Auguie

dielectric2plot *dielectric2plot*

Description

Conversion to long format data.frame for plotting

Usage

dielectric2plot(m)

Arguments

m data.frame with wavelength and complex epsilon

Details

Conversion to long format data.frame for plotting

Value

long format data.frame

Author(s)

baptiste Auguie

drude

drude

Description

Drude model for the dielectric function of good (governed by free electrons) metals

Usage

```
drude(
  wavelength = 633,
  p = c(1e+16, 1e+14, 1),
  omega = 2 * pi * 1e+09 * 299792458/wavelength,
  omega_p = p[1],
  gamma_p = p[2],
  epsilon_inf = p[3],
  ...
)
```

Arguments

wavelength	wavelength in nm
p	vector of 3 parameters
omega	angular frequency in rad/s
omega_p	plasma frequency in rad/s
gamma_p	damping constant, in rad/s
epsilon_inf	background dielectric function
...	not used

Details

a background contribution eps_inf is assumed for the core electrons

Value

a data.frame with wavelength in nm and complex dielectric function

Author(s)

Baptiste Auguie

epsAg

epsAg

Description

permittivity silver

Usage

```
epsAg(wavelength, epsilon.inf = 4, lambda.p = 282, mu.p = 17000)
```

Arguments

wavelength	wavelength in nm
epsilon.inf	background dielectric constant
lambda.p	plasma wavelength
mu.p	damping constant

Details

analytical dielectric function of Silver (Drude model)

Value

data.frame

Author(s)

baptiste Auguie

References

Principles of surface-enhanced Raman spectroscopy and related plasmonic effects Eric C. Le Ru and Pablo G. Etchegoin, published by Elsevier, Amsterdam (2009).

See Also

Other user_level permittivity: [epsAu\(\)](#)

Examples

```
require(dielectric) ; data(AgPalik)
wvl <- seq(300, 900)
silver <- epsAg(wvl)

matplot(silver$wavelength, cbind(Re(silver$epsilon), Im(silver$epsilon)),
t="l", lty=1, xlab = "wavelength / nm", ylab = "Dielectric function")
matpoints(AgPalik$wavelength, cbind(Re(AgPalik$epsilon), Im(AgPalik$epsilon)), pch=1)
```

epsAu

*epsAu***Description**

permittivity gold

Usage

```
epsAu(
  wavelength,
  epsilon.infty = 1.54,
  lambda.p = 177.5,
  mu.p = 14500,
  A1 = 1.27,
  phi1 = -pi/4,
  lambda1 = 470,
  mu1 = 1900,
  A2 = 1.1,
  phi2 = -pi/4,
  lambda2 = 325,
  mu2 = 1060
)
```

Arguments

wavelength	wavelength in nm
epsilon.infty	background dielectric constant
lambda.p	plasma wavelength
mu.p	damping constant
A1	A1
phi1	phi1
lambda1	lambda1
mu1	mu1
A2	A2
phi2	phi2
lambda2	lambda2
mu2	mu2

Details

analytical dielectric function of Au (Drude model + interband transitions)

Value

data.frame

Author(s)

baptiste Auguie

References

Principles of surface-enhanced Raman spectroscopy and related plasmonic effects Eric C. Le Ru and Pablo G. Etchegoin, published by Elsevier, Amsterdam (2009).

See Also

Other user_level permittivity: [epsAg\(\)](#)

Examples

```
require(dielectric) ; data(AuJC)
wvl <- seq(300, 900)
gold <- epsAu(wvl)

matplot(gold$wavelength, cbind(Re(gold$epsilon), Im(gold$epsilon)),
t="l", lty=1, xlab = "wavelength / nm", ylab = "Dielectric function")
matpoints(AuJC$wavelength, cbind(Re(AuJC$epsilon), Im(AuJC$epsilon)), pch=1)
```

eV2L

eV2L

Description

Unit conversions

Usage

eV2L(energy)

Arguments

energy energy in eV

Details

Unit conversions

See Also

Other conversion: [L2eV\(\)](#), [L2w\(\)](#), [t2eV\(\)](#)

fit_drude	<i>fit_drude</i>
-----------	------------------

Description

Objective function for the Drude model

Usage

```
fit_drude(p, material, ...)
```

Arguments

p	parameters vector (3)
material	data.frame with wavelength in nm and complex epsilon
...	passed to drude

Details

Used to fit a Drude model to a material

Value

sum of squares

Author(s)

Baptiste Auguie

L2eV	<i>L2eV</i>
------	-------------

Description

Unit conversions

Usage

```
L2eV(wavelength)
```

Arguments

wavelength	wavelength in m
------------	-----------------

Details

Unit conversions

Value

converted unit

See Also

Other conversion: [L2w\(\)](#), [eV2L\(\)](#), [t2eV\(\)](#)

L2w

L2w

Description

Unit conversions

Usage

L2w(wavelength)

Arguments

wavelength wavelength in m

Details

Unit conversions

See Also

Other conversion: [L2eV\(\)](#), [eV2L\(\)](#), [t2eV\(\)](#)

sapphire	<i>Sapphire in the visible</i>
----------	--------------------------------

Description

Dielectric dataset

Usage

sapphire

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

t2eV	<i>t2eV</i>
------	-------------

Description

Unit conversions

Usage

t2eV(time)

Arguments

time time in s

Details

Unit conversions

See Also

Other conversion: [L2eV\(\)](#), [L2w\(\)](#), [eV2L\(\)](#)

Ti *Amorphous silicon in the visible*

Description

Dielectric dataset

Usage

Ti

Format

A dielectric reference class with 4 fields

wavelength in nm

epsilon dielectric function

span range of wavelengths

comment optional information

Source

[/https://refractiveindex.info/](https://refractiveindex.info/)

Index

- * **conversion**
 - eV2L, [10](#)
 - L2eV, [11](#)
 - L2w, [12](#)
 - t2eV, [13](#)
- * **datasets**
 - AgPalik, [2](#)
 - AlRakic, [3](#)
 - aSi, [3](#)
 - AuJC, [4](#)
 - Chromium, [4](#)
 - constants, [5](#)
 - sapphire, [13](#)
 - Ti, [14](#)
- * **user_level permittivity**
 - epsAg, [8](#)
 - epsAu, [9](#)
- * **user_level utility**
 - clausius_mossotti, [5](#)

AgPalik, [2](#)
AlRakic, [3](#)
aSi, [3](#)
AuJC, [4](#)

Chromium, [4](#)
clausius_mossotti, [5](#)
constants, [5](#)

dielectric (dielectric-class), [6](#)
dielectric-class, [6](#)
dielectric2plot, [6](#)
drude, [7](#)

epsAg, [8](#), [10](#)
epsAu, [8](#), [9](#)
eV2L, [10](#), [12](#), [13](#)

fit_drude, [11](#)

L2eV, [11](#), [11](#), [12](#), [13](#)

L2w, [11](#), [12](#), [12](#), [13](#)

sapphire, [13](#)

t2eV, [11](#), [12](#), [13](#)
Ti, [14](#)