Package 'dielectric'

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Title Defines some physical constants and dielectric functions commonly used in optics, plasmonics.

Type Package

LazyLoad yes

LazyData yes

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

Version 0.2.3

Date 2012-03-04

Depends R (>= 2.13), methods

Suggests ggplot2

Collate 'conversions.R' 'dielectric.r' 'plot.r' 'zzz.r' 'drude.r' 'metals.r'

Author Baptiste Auguie [aut, cre] (the original data have their original source listed in the help file.)

NeedsCompilation no

Repository CRAN

Date/Publication 2013-11-09 22:00:36

R topics documented:

`AgPalik` *AgPalik*

Description

Silver dielectric function from Palik

Usage

```
data(AgPalik)
```

Source

E. D. Palik. Handbook of Optical Constants of Solids, volume I. Academic Press, 1985 luxpop.com

Examples

```
data(AgPalik)
str(AgPalik$raw())
AgPalik$comment
demo(AgPalik)
```

`aSi` *aSi*

Description

Amorphous Si dielectric function

Usage

```
data(aSi)
```

Source

http://refractiveindex.info/?group=CRYSTALS&material=a-Si

Examples

```
data(aSi)
str(aSi$raw())
```

AuJC *AuJC*

Description

Gold dielectric function from Johnson and Christy

Usage

```
data(AuJC)
```

Source

P. B. Johnson and R. W. Christy. Optical constants of the noble metals. Phys. Rev. B, 6:4370–4379, 1972. luxpop.com

Examples

```
data(AuJC)
str(AuJC$raw())
AuJC$comment
demo(AuJC)
```

constants *constants*

Description

Physical constants

Usage

```
data(constants)
```

Source

NIST

References

wikipedia

Examples

```
data(constants)
constants
comment(constants$cel)
```

dielectric-class *Class "dielectric"*

Description

Set of R methods to transform dielectric functions

Fields

`wavelength`: numeric vector

`epsilon`: complex vector

Methods

`predict(sp, range, n, new.wavelength, ...)`: new values from spline interpolation of the data

`spline(...)`: spline interpolation of the data

`raw()`: raw data as a data.frame with real and imaginary parts

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 bacground 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)
```

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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 *fit_drude*

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 *L2eV*

Description

Unit conversions

Usage

```
L2eV(wavelength)
```

Arguments

wavelength	wavelength in m

Details

Unit conversions

Value

converted unit

See Also

Other conversion: eV2L, L2w, t2eV

L2w *L2w*

Description

Unit conversions

Usage

```
L2w(wavelength)
```

Arguments

wavelength	wavelength in m

Details

Unit conversions

See Also

Other conversion: eV2L, L2eV, t2eV

t2eV t2eV

Description

Unit conversions

Usage

```
t2eV(time)
```

Arguments

time	time in s

Details

Unit conversions

See Also

Other conversion: eV2L, L2eV, L2w

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