X-ray data booklet (http://xdb.lbl.gov/xdb-new.pdf)

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1.7 atomic scattering factors
1.6 mass absorption coefficients

index of refraction

$n = 1 - \delta - i \cdot \beta$

$= 1 - re / (2 \cdot \pi) \cdot \lambda\hat{}2 \cdot \Sigma\_j\ N(j) \cdot f(j)$ (1.7.1)

δ	refractive index decrement (RID)
β	absorption index
re	classical electron radius = 2.817940289458e–15 [m]
λ	wave length
N(j)	number of element "j" per unit volume
f(j)	atomic scattering factor of element "j"

λ [m] = (h • c / e) / E [eV] = 1.239841576558181422983e–6 / E [eV]

h	Planck constant = 6.6260689633e–34 [J • s]
c	speed of light = 2.99792458e+8 [m / s]
e	electron charge = 1.6021768740e–19 [C]
E [eV]	photon energy in eV

$N(j) = na \cdot \rho \cdot w(j) / A(j)$

na	Avogradro’s number = 6.0221417930e+23 [1 / mol]
ρ	density of material (including element "j")
w(j)	weight ratio of element "j"
A(j)	atomic weight of element "j"

$f(j) = f1(j) + i \cdot f2(j)$ (1.7.2)

http://henke.lbl.gov/optical_constants/sf/sf.tar.gz

RID

$\delta = \rho \cdot na \cdot re / (2 \cdot \pi) \cdot \lambda\hat{}2 \cdot \Sigma\_j\ w(j) \cdot f1(j) / A(j)$

atomic mass RID (MRID)

$\Delta(j) = na \cdot re / (2 \cdot \pi) \cdot \lambda\hat{}2 \cdot f1(j) / A(j)$

$\rightarrow$

$\delta = \rho \cdot \Sigma\_j\ w(j) \cdot \Delta(j)$

absorption index

$\beta = \rho \cdot na \cdot re / (2 \cdot \pi) \cdot \lambda\hat{}2 \cdot \Sigma\_j\ w(j) \cdot f2(j) / A(j)$

atomic photo-absorption cross section

$\sigma(j) = 2 \cdot re \cdot \lambda \cdot f2(j)$ (1.7.3)

atomic mass photo-absorption coefficients (MPAC)

$\tau(j) = na \cdot \sigma(j) / A(j)$ (1.6.2)

$= na \cdot 2 \cdot re \cdot \lambda \cdot f2(j) / A(j)$

linear photo-absorption coefficients (LPAC)

$\mu = \rho \cdot \Sigma\_j\ w(j) \cdot \tau(j)$ (1.6.3)

$= (4 \cdot \pi / \lambda) \cdot \beta$