Geophysical Research Abstracts, Vol. 7, 08055, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08055


# Low-density silica phases: Refraction of light - the Gladstone-Dale law

S. Maj / IGPh-PAS

Institute of Geophysics, Pol.Acad.Sci., ul. Ks.Janusza 64, 01-452 Warsaw, Poland (maj@igf.edu.pl/(48)(22)69-15-915)

A linear relationship between the refractive index (n) and the density (d), often called the Gladstone-Dale law or specific refraction SR = (n-1)/d = const, for low-density silica geomaterials is derived from two atomic properties of a silicon bioxide solid phase. These properties are the mean atomic weigt (<A> = 20.03 g/mol) and wide energy gap (EG). The considerations are based on the Lorentz electron theory of solids. The eigenfrequency (fo) of elementary electron oscillators, in energy units hfo (h denotes Planck's constant), is identified with the EG of low-quartz.This EG, on the other hand, is identified with the mean first ionization potential of a non-free silicon and oxygen atoms complex (one atom of Si and two atoms of O). The numerical values of SR, in cc/g, are 0.212 and 0.208 if we assume that EG is equal to 10.1 eV (calculated value) and 10.2 eV (empirical value), respectively. Natural silica polymorphs from silica glass (lechatelierite) to low-quartz have the following values of SR (in cc/g): 0.209-0.206. From laboratory data of synthetical isotropic silica phases, called "porosils", we obtain that SR = 0.208-0.214 cc/g. Various other silica materials as, e.g., chalcedony, opal, chert, and also obsidian and tektites suggest similar values of SR: 0.209-0.213 cc/g.