Refractive Index and Transparency

When light passes from a vacuum into a denser material, its velocity is decreased. The ratio between these velocities determines the index of refraction (or refractive index) n:

$$n = V_{vaccuo} / V_{material}$$

The refractive index is a function of the frequency of the light, normally decreasing as the wavelength increases. Usually, the values at the mean wavelength of the sodium doublet, n_D, i.e. 589.3 nm are quoted.

Metals are characterized by a large reflectivity. On the contray, very little light is reflected by glass. Experiments have shown that for insulators, the reflectivity $\boldsymbol{R}$ depends solely on the index of refraction:

$$\boldsymbol{R} = (n-1)^2 / (n+1)^2$$

The reflectivity diminishes transparency by the factor $(1 - 2\boldsymbol{R})$. The following table lists a series of refractive index and their relative reflectivity and transparency.

Refractive Index	Reflectivity	Transparency (%)
1.0	0	100
1.1	0.007	99.3
1.2	0.008	99.2
1.3	0.017	98.3
1.4	0.028	97.2
1.5	0.040	96.0
1.6	0.053	94.7
1.7	0.067	93.3
1.8	0.082	91.8
1.9	0.096	90.4
2.0	0.111	88.9

It is important to note that the impairment of transparency of glass must be based on an interaction with light. The strongest interaction is present when free electrons occur in a substance. The metals are such substances, which thus are completely impervious to light.