

Gemstone Refractive Index Chart

Have you ever wondered what makes a certain gemstone have that certain quality of light refraction? Even when there is surface reflection, there are deeper effects under the surface. This is caused by how the light entering the gemstone is bent and slowed down. It will often reflect off the inner side of the surface, and this is one of the aspects of its beauty. Jewelers and Gemstone Cutters design their cuts to maximize this effect. Lens makers use these values to determine the curvature of a particular lens to achieve the desired focal distance.

Many gemstones have something known to the industry as Double Refraction. I searched for the definition of this term and learned the following:

(Excerpt from first result in my Google search.)

double re·frac·tion - *The separation of a ray of light into two unequally refracted, plane-polarized rays of orthogonal polarizations, occurring in crystals in which the velocity of light rays is not the same in all directions.*

*Also called **birefringence**.*

So, I decided to do some research, and compile a list in a chart format from the results I found. That list is provided below, and has been sorted alphabetically to allow any user to easily find a specific type of gemstone and learn its refractive index.

You will note that both the 'Refractive Index', and the 'Double Refraction' values are provided as a range of value for most gemstones, thus indicating that those property values for a particular gemstone fall within that range. This is due to the light and temperature differences which are interacting with the gemstone. The reason temperature is relevant is because when a substance is warmer it is normally less dense than when it is cooler. Density has a direct influence on the refractive index of most refractive substances.

When and if a stone has double refraction, that value is also provided. Certain gemstones will have only one value in either their 'Refractive Index', or their 'Double Refraction', or both; as these are stones that may have particularities that make this possible. If the stone has no double refraction, the word 'None' replaces the value. Note that for Diamond, the 'Double Refraction' value is replaced by the word 'Anomalous'. I have yet to find a reason for this, so cannot provide what I do not know. It does mark the Diamond as a unique substance, however; and could be one reason it often has such high value in the gemstone market. More research is needed on that aspect of this gemstone.

The reason I have put this chart together is to help those of us that wish to create realistic looking gemstones to know what values should work for a specific gemstone in the refraction channels of our chosen application. These values should work for

any of the best applications that have such a feature, and that have a render engine that can handle refractive indices. Blender, Bryce, DAZ Studio, and Poser are the only ones I have that can handle such values; however I know there are many other applications that have that ability as well. This chart should be useful for all of them as a help for the user to be able to do realistic gemstone quality materials for any gemstone they wish to create.

Note: I did not provide values for glass, as there are many types of glass, which have unique refractive indices.

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As always, have fun using this document to help with your art and/or product creation.

And Now, The List:

Gemstone	Refractive Index	Double Refraction
Actinolite	1.614 – 1.653	0.020 – 0.025
Adamite	1.708 – 1.760	0.048 – 0.050
Aegirine-augite	1.700 – 1.800	0.030 – 0.050
Agate	1.530 -1.540	0.004 – 0.009
Almandine	1.770 – 1.820	None
Amazonite	1.522 – 1.530	0.008
Amber	1.539 – 1.545	None
Amblygonite	1.578 – 1.646	0.024 – 0.030
Amethyst	1.544 – 1.553	0.009
Amethyst	1.54 – 1.55	0009 Quartz
Ammonite	1.52 – 1.68	0.155
Analcime	1.479 – 1.489	None
Anatase	2.488 – 2.564	0.046 – 0.067
Andalusite	1.627 – 1.649	0.007 – 0.013
Andesine	1.543 – 1.551	0.008
Andradite	1.88 – 1.94	None

Anglesite	1.878 – 1.895	0.017
Anhydrite	1.570 – 1.614	0.044
Apatite	1.628 – 1.649	0.002 – 0.006
Apophyllite	1.535 – 1.537	0.002
Aquamarine	1.564 – 1.596	0.004 – 0.005
Aragonite	1.530 – 1.685	0.155
Augelite	1.570 – 1.590	0.014 – 0.020
Aventurine	1.544 – 1.553	0.009
Axinite	1.656 – 1.704	0.010 – 0.012
Azurite	1.720 – 1.848	0.108 – 0.110
Baryte	1.636 – 1.648	0.012
Bayldonite	1.95 – 1.99	0.04
Benitoite	1.757 – 1.804	0.047
Beryllonite	1.552 – 1.561	0.009
Boleite	2.03 – 2.05	0.020
Boracite	1.658 – 1.673	0.010 – 0.011
Brazilianite	1.602 – 1.623	0.019 – 0.021
Brookite	2.583 – 2.700	0.117
Bustamite	1.662 – 1.707	0.014 – 0.015
Calcite	1.486 – 1.658	0.172
Cancrinite	1.495 – 1.528	0.024 – 0.029
Carletonite	1.517 – 1.521	0.004
Cassiterite	1.997 – 2.098	0.096 – 0.098
Catapleite	1.590 – 1.629	0.039
Celestine	1.619 – 1.635	0.010 – 0.012
Celluloid	1.495 – 1.520	None
Cerussite	1.804 – 2.079	0.274
Chalcedony	1.530 -1.540	0.004 – 0.009
Chambersite	1.732 – 1.744	0.012
Charoite	1.550 – 1.561	0.004 – 0.009
Chondrodite	1.592 – 1.646	0.028 – 0.034
Chrysoberyl	1.746 – 1.763	0.007 – 0.011
Chrysocolla	1.460 – 1.570	0.023 – 0.040
Chrysoprase	1.530 -1.540	0.004 – 0.009
Cinnabar	2.905 – 3.256	0.351
Citrine	1.544 – 1.553	0.009
Clinohumite	1.629 – 1.674	0.028 – 0.041
Clinozoisite	1.670 – 1.734	0.010
Colemanite	1.586 – 1.615	0.028 – 0.030
Coral	1.486 – 1.658	0.160 -0.172
Cordierite	1.542 – 1.578	0.008 – 0.012
Cornerupine	1.660 – 1.699	0.012 – 0.017
Creedite	1.461 – 1.485	0.024
Crocoite	2.29 – 2.66	0.270
Cuprite	2.849	None
Danburite	1.630 – 1.636	0.006 – 0.008
Datolite	1.621 – 1.675	0.040 – 0.050
Diamond	2.417 – 2.419	Anomalous

Diaspore	1.702 – 1.750	0.048
Diopside	1.664 – 1.730	0.024 – 0.031
Diophtase	1.644 – 1.709	0.051 – 0.053
Dolomite	1.502 – 1.698	0.185
Dumortierite	1.678 – 1.689	0.015 – 0.037
Ekanite	1.572 – 1.573	0.001
Emerald	1.565 – 1.602	0.006
Enstatite	1.650 – 1.680	0.009 – 0.012
Eosphorite	1.638 – 1.671	0.028 – 0.035
Epidote	1.729 – 1.768	0.015 – 0.049
Euclase	1.650 – 1.677	0.019 – 0.025
Eudialyte	1.591 -1.633	0.003 – 0.010
Fabulite	2.409	None
Flourite	1.434	None
Friedelite	1.625 -1.664	0.030
Gadolinite	1.77 – 1.82	0.01 – 0.04
Gahnite	1.791 – 1.818	None
Gahnospinel	1.715 – 1.754	None
Gaspéite	1.61 – 1.81	0.22
Gaylussite	1.443 – 1.523	0.080
GGG	1.970 – 2.020	0.058
Glass	1.44 – 1.90	None
Grossular	1.734 – 1.759	None
Gypsum	1.520 – 1.529	0.009
Hambergite	1.553 – 1.628	0.072
Häüyne	1.496 – 1.510	None
Hematite	2.940 – 3.220	0.287
Hemimorphite	1.614 – 1.636	0.022
Herderite	1.587 – 1.627	0.023 – 0.032
Hessonite	1.730 – 1.757	None
Hiddenite	1.660 – 1.681	0.014 – 0.016
Hodgkinsonite	1.719 – 1.748	0.022 – 0.026
Howlite	1.586 – 1.605	0.019
Hypersthene	1.673 – 1.731	0.010 – 0.016
Inderite	1.486 – 1.507	0.017 – 0.020
Ivory	1.535 – 1.570	None
Jadeite	1.652 – 1.688	0.20
Jasper	1.54	None
Jeremejevite	1.637 0 1.653	0.007 – 0.013
Jet	1.640 – 1.680	None
Kunzite	1.660 – 1.681	0.014 – 0.016
Kurnakovite	1.488 – 1.525	0.036
Kyanite	1.710 – 1.734	0.015 – 0.033
Lapis Lazuli	1.5	None
Larbradorite	1.559 – 1.570	0.008 – 0.010
Lawsonite	1.665 – 1.686	0.019 – 0.021
Lazulite	1.612 – 1.646	0.031 – 0.036
Legrandite	1.675 – 1.740	0.060

Leucite	1.504 – 1.509	0.001
Linobate	2.21 – 2.30	0.090
Lithiophilite	1.68 – 1.70	0.01
Ludlamite	1.650 – 1.697	0.038 – 0.044
Magnesite	1.509 – 1.717	0.022
Malachite	1.655 – 1.909	0.254
Manganotantalite	2.19 – 2.34	0.150
Meliphanite	1.593 – 1.612	0.019
Mesolite	1.504 – 1.508	0.001
Milarite	1.529 -1.551	0.003
Mimetite	2.120 – 2.135	0.015
Moldavite	1.48 – 1.54	None
Monazite	1.774 – 1.849	0.049 – 0.055
Montebrasite	1.594 -1.633	0.22
Moonstone	1.518 – 1.526	0.008
Moss agate	1.530 -1.540	0.004 – 0.009
Muscovite	1.552 – 1.618	0.036 – 0.043
Natrolite	1.480 – 1.493	0.013
Nepheline	1.526 – 1.546	0.0004
Nephrite	1.600 – 1.627	0.027
Neptunite	1.690 – 1.736	0.029 – 0.045
Obsidian	1.45 – 1.55	None
Odontolite	1.60 – 1.64	0.010
Oligoclase	1.542 – 1.549	0.007
Opal	1.37 – 1.52	None
Orthoclase	1.518 – 1.530	0.008
Painite	1.787 – 1.816	0.029
Parisite	1.671 – 1.772	0.081 – 0.101
Pearl	1.52 – 1.69	0.156
Pectolite	1.595 – 1.645	0.038
Periclase	1.74	None
Peridot	1.650 – 1.703	0.036 – 0.038
Petalite	1.502 – 1.519	0.012 – 0.017
Petrified Wood	1.54	None
Phenakite	1.650 – 1.670	0.016
Phosgenite	2.114 – 2.145	0.028
Phosphophyllite	1.594 – 1.621	0.021 – 0.033
Pollucite	1.517 – 1.525	None
Prasiolite	1.544 – 1.553	0.009
Precious Beryl	1.562 – 1.602	0.004 – 0.010
Prehnite	1.611 – 1.669	0.021 – 0.039
Proustite	2.881 – 3.084	0.203
Purpurite	1.85 – 1.92	0.007
Pyrargyrite	2.88 – 3.08	0.200
Pyrope	1.720 – 1.756	None
Pyrophyllite	1.552 – 1.600	0.048
Pyroxmangite	1.726 – 1.764	0.016 – 0.020
Rhodizite	1.690	None

Rhodochrosite	1.600 – 1.820	0.208 – 0.220
Rhodonite	1.716 – 1.752	0.010 – 0.014
Rock Crystal	1.544 – 1.553	0.009
Rose quartz	1.544 – 1.553	0.009
Ruby	1.762 -1.778	0.008
Rutile	2.616 – 2.903	0.287
Sanidine	1.518 – 1.530	0.008
Sapphire	1.762 -1.778	0.008
Sapphirine	1.701 – 1.734	0.004 – 0.007
Scapolite	1.540 – 1.579	0.006 – 0.037
Scheelite	1.918 – 1.937	0.010 – 0.018
Scolecite	1.509 – 1.525	0.007 – 0.012
Scorodite	1.738 – 1.816	0.027 – 0.030
Sellaite	1.378 -1.390	0.012
Senarmontite	2.087	None
Sepiolite	1.53	None
Serendibite	1.701 – 1.743	0.005
Serpentine	1.560 – 1.571	0.008 – 0.014
Shattuckite	1.752 – 1.815	0.063
Siderite	1.633 – 1.875	0.242
Sillimanite	1.655 – 1.684	0.014 – 0.021
Simpsonite	1.994 – 2.040	0.058
Sinhalite	1.665 – 1.712	0.036 – 0.042
Smithsonite	1.621 – 1.849	0.228
Smoky quartz	1.544 – 1.553	0.009
Sodalite	1.48	None
Sogdianite	1.606 – 1.608	0.002
Spessartine	1.790 – 1.820	None
Sphalerite	2.368 – 2.371	None
Spinel	1.712 – 1.762	None
Spurrite	1.637 – 1.681	0.039 – 0.040
Staurolite	1.736 – 1.762	0.010 – 0.015
Stibiotantalite	2.370 – 2.450	0.080
Stichtite	1.516 – 1.544	0.026
Strontianite	1.52 – 1.67	0.150
Sugilite	1.607 – 1.611	0.001 – 0.004
Sulphur	1.958 – 2.245	0.291
Sunstone	1.525 – 1.548	0.01
Taaffeite	1.719 – 1.730	0.004 – 0.009
Talc	1.54 – 1.59	0.050
Tantalite	2.26 – 2.43	0.160
Tanzanite	1.691 – 1.700	0.009
Thaumasite	1.464 – 1.507	0.036
Thomsonite	1.515 – 1.542	0.006 – 0.025
Tiger's-eye	1.534 – 1.540	None
Titanite	1.843 – 2.110	0.100 – 0.192
Topaz	1.609 – 1.643	0.008 – 0.016
Tourmaline	1.614 – 1.666	0.014 – 0.032

Tremolite	1.560 – 1.643	0.017 – 0.027
Triphylite	1.689 – 1.702	0.006 – 0.008
Tugtupite	1.496 – 1.502	0.006
Turquoise	1.610 – 1.650	0.040
Ulexite	1.491 – 1.520	0.029
Uvarovite	1.865	None
Variscite	1.563 – 1.594	0.031
Vesuvianite	1.700 – 1.723	0.002 – 0.012
Vivianite	1.560 – 1.640	0.050 – 0.075
Wardite	1.590 – 1.599	0.009
Whewellite	1.489 – 1.651	0.159 – 0.163
Willemite	1.690 – 1.723	0.028 – 0.033
Witherite	1.529 – 1.677	0.148
Wulfenite	2.280 – 2.400	0.120
YAG	1.833 – 1.835	None
Yugawaralite	1.490 – 1.509	0.011 – 0.014
Zektzerite	1.582 – 1.585	0.003
Zincite	2.013 – 2.029	0.016
Zircon	1.810 – 2.024	0.0002 – 0.059
Zirconia	2.150 – 2.180	None