

# Iron Doped Lithium Niobate

## Product Description

Deltronic Crystal's Iron-Doped Lithium Niobate is one of the most preferred photorefractive materials due to its superior photorefractive properties.

Iron-Doped Lithium Niobate is a ferroelectric crystal with the paraelectric to ferroelectric phase transition around 1143 C°. Boules are electrically poled along the Z-axis to align antiparallel domains of the spontaneous polarization.

Deltronic Crystal regularly grows large diameter boules of iron-doped lithium niobate for photorefractive applications. Lithium niobate is chemically stable at room temperature and is generally non-reactive to most solvents.

## Applications

- Astronomical Filters
- Spectroscopic Filters
- Holographic Applications
- Holographic Data Storage
- Wavelength Division Multiplexing

## Features

- Strong Photovoltaic Effects
- High Electro-optic Coefficients
- High Photorefractive Sensitivity
- High Diffraction Efficiency
- Grown by Czochralski Method

Figure 1. Holographic Optical Filter

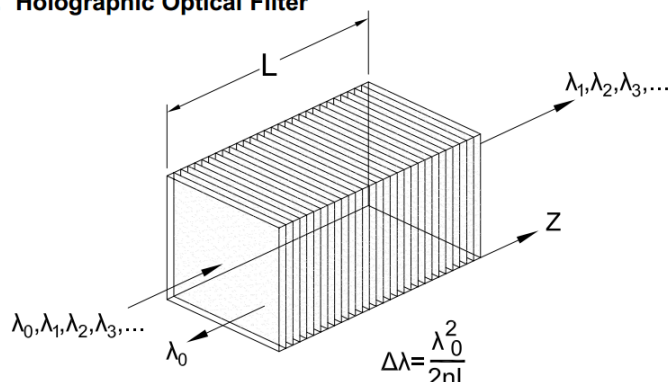
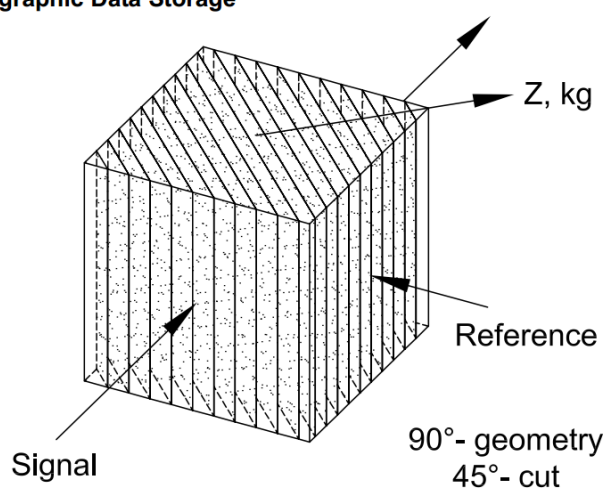


Figure 2. Holographic Data Storage



| Property at 25°C                                  | Value  |
|---|--|
| Empirical Formula                                 | LiNbO <sub>3</sub> :Fe   |
| Congruent Melt Composition                        | 48.6 mole % Li <sub>2</sub> O  |
| Congruent Melting Point (°C)                      | 1253   |
| Crystal Structure                                 | trigonal   |
| Space Group                                       | R3c  |
| Bandgap (eV)                                      | 3.7  |
| Point Group                                       | 3m   |
| Curie Temperature (°C)                            | 1143   |
| Density (g-cm <sup>-3</sup> )                     | 4.612  |
| Hardness (moh)                                    | 5  |
| Thermal Expansion Coefficient (°C <sup>-1</sup> ) | a = 16.7x10 <sup>-6</sup><br>c = 2.0 x 10 <sup>-6</sup>  |
| Resistivity (ohm-cm)                              | > 1014 at 200°C  |
| Lattice Constant (Å)                              | a = 5.1508 (hex)<br>c = 13.864 (hex)   |
| Spontaneous Polarization (Coul/m <sup>2</sup> )   | 0.71   |
| Dielectric Constants                              | ǫ <sub>33</sub> <sup>s</sup> = 29 ǫ <sub>11</sub> <sup>s</sup> = 44<br>ǫ <sub>33</sub> <sup>s</sup> = 30 ǫ <sub>11</sub> <sup>T</sup> = 84 |
| Refractive index, 514.5nm                         | n <sub>o</sub> = 2.2029, n <sub>e</sub> = 2.1476   |
| Refractive Index, 633nm                           | n <sub>o</sub> = 2.2884, n <sub>e</sub> = 2.2019   |

|  |   |
|--|---|
| Refractive Index, 1064nm   | $n_o = 2.2340, n_e = 2.1554$  |
| Electro-optic Coefficients at 633nm<br>[pm/V] (constant tension) | $r_{13} = 9.6 \ r_{22} = 6.8 \ r_{33} = 30.9$<br>$r_{51} = 32.6 \ r_c = 21.1$ |

### Crystallographic Orientations, Dimensions, and Tolerances

|                          |  |
|--------------------------|--|
| Standard Sizes           | 10x10x10mm <sup>3</sup> , 0° cut and 45° cut<br>10x10x20mm <sup>3</sup> , 0° cut and 45° cut |
| Dimension Tolerances     | ±0.1mm on polished faces<br>±0.1mm on lapped faces   |
| Orientations             | X-ray oriented within ±10 arc-minutes  |
| Flatness                 | <λ/10 at 633nm   |
| Surface Quality          | <10/5 (scratch/dig)  |
| Edges                    | 0.1 to 0.15mm chamfer at 45°   |
| Parallelism              | <10 arc-minutes  |
| Anti-reflective Coatings | Specify  |
| Other Dopants            | Specify  |
| Fe Standard Dopants      | 0.015, 0.03, 0.05, 0.10 mole%  |