

## TeO<sub>2</sub> DATA SHEET

TeO<sub>2</sub> (Tellurium Dioxide) is a birefringent crystal that exhibits a high acousto-optic figure of merit and is used in many of our acousto-optic devices. It is grown at Isomet by the Czochralski method with a typical boule size of 2" diameter by 2" long. The physical and optical properties of TeO<sub>2</sub> are shown below:

### Density<sup>1</sup>

$$\rho = 5.99 \frac{\text{g}}{\text{cm}^3}$$

### Hardness

4 Mohs

### Transparency<sup>1</sup>

0.34-4.5  $\mu\text{m}$

### Melting Temperature<sup>1</sup>

$t_m = 730^\circ\text{C}$



### Thermal expansion coefficients<sup>1</sup>

$$\alpha_{\parallel a} = 15 \times 10^{-6} / \text{K} \quad , \quad \alpha_{\parallel c} = 4.9 \times 10^{-6} / \text{K}$$

### Birefringence ( $\Delta n = n_e - n_o @ \lambda = 1.550 \mu\text{m}$ )<sup>3</sup>

$$\Delta n = 0.140; \quad n_o = 2.180; \quad n_e = 2.320;$$

### Effective Birefringence ( $\lambda = 1.550 \mu\text{m}$ )<sup>2</sup>

$$\Delta n_{\text{eff}} = 0.144$$

### Thermo-optic coefficient ( $\lambda = 1.550 \mu\text{m}$ )<sup>2</sup>

$$\frac{d(\Delta n_{\text{eff}})}{dT} = 23.53 \times 10^{-6} / \text{K}$$

### Crystal type & space group<sup>1</sup>

Positive uniaxial; Tetragonal, P4<sub>2</sub>, a=4.81, c=7.613 Angstroms

### Sellmeier Equation (wavelength, $\lambda$ , in $\mu\text{m}$ ; $\lambda$ range: 0.4-1.0 $\mu\text{m}$ )<sup>1</sup>

$$n_o = \sqrt{1 + \frac{2.584\lambda^2}{\lambda^2 - (0.1342)^2} + \frac{1.157\lambda^2}{\lambda^2 - (0.2638)^2}} \quad n_e = \sqrt{1 + \frac{2.823\lambda^2}{\lambda^2 - (0.1342)^2} + \frac{1.542\lambda^2}{\lambda^2 - (0.2631)^2}}$$

### References

<sup>1</sup>"Handbook of Optics" by the Optical Society of America; Michael Bass, editor in chief, 2<sup>nd</sup> edition, volume II, 1995; Part 4 - Optical and Physical Properties of Materials.

<sup>2</sup>Isomet measurement;  $\Delta n_{\text{eff}} = \Delta n - \lambda \frac{\partial(\Delta n)}{\partial \lambda}$

<sup>3</sup>Ellipsometry measurement

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