PbMoO₄ DATA SHEET

PbMoO₄ (Lead Molybdate) is a birefringent crystal that was originally developed in 1969 by Bell Laboratories for acousto-optic applications. It is grown by the Czochralski method with a typical boule size of 1” diameter by 4” long. PbMoO₄ is currently used in both acousto-optic devices and in polarization-based passive components for telecommunications. In spite of its relatively high refractive index, the surface reflection can be reduced below 0.1% from 1510-1590 nm for both “s” and “p” polarizations by anti-reflection coating. The physical and optical properties of PbMoO₄ are shown below:

Density¹
\[ \rho = 6.95 \text{ g/cm}^3 \]

Hardness²
3 Mohs

Transparency¹
0.42-5.5 µm

Melting Temperature³
\[ t_m = 1338K \]

Thermal expansion coefficients⁴
\[ \alpha_{||a} = 12.4 \times 10^{-6} / \text{K} \quad \alpha_{||c} = 26.7 \times 10^{-6} / \text{K} \]

Effective Birefringence (\( \lambda = 1.550 \text{ µm} \))⁴
\[ \Delta n_{\text{eff}} = 0.104 \]

Thermo-optic coefficient (\( \lambda = 1.550 \text{ µm} \))⁴
\[ \frac{d(\Delta n_{\text{eff}})}{dT} = 190 \times 10^{-6} / \text{K} \]

Crystal type & space group¹
Negative uniaxial; Tetragonal, \( I4_1 / a(C_{4h}^0) \), \( a=5.4312, c=12.1065 \) Angstroms

Sellmeier Equation (wavelength, \( \lambda \), in µm; \( \lambda \) range: 0.44-1.08 µm)³
\[
\begin{align*}
    n_o &= \sqrt{1 + \frac{3.54642\lambda^2}{\lambda^2 - (0.18518)^2} + \frac{0.58270\lambda^2}{\lambda^2 - (0.33764)^2}} \\
    n_e &= \sqrt{1 + \frac{3.52555\lambda^2}{\lambda^2 - (0.17950)^2} + \frac{0.20660\lambda^2}{\lambda^2 - (0.32537)^2}}
\end{align*}
\]

References
¹ N. Uchida and N. Niizeki, IEEE Proc. 61 (1973) p. 1073
⁴ Isomet measurement; \( \Delta n_{\text{eff}} = \Delta n - \lambda \frac{\partial (\Delta n)}{\partial \lambda} \)
⁵ Ellipsometry measurement