International Tables for Crystallography (2013). Vol. D, References, pp. 179–180.

$$\Delta\eta_6 = p_{66}S_6\sin(\omega t - k\xi) = p_{44}S_6\sin(\omega t - k\xi) \qquad (1.6.7.14)$$

since all other components are zero. This means that the original spherical indicatrix of the cubic crystal has been distorted to form a biaxial indicatrix whose axes oscillate in length according to

$$\begin{aligned} n_1 &= n_{\rm cub} + \frac{n^3_{\rm cub}}{2}p_{44}S_6\sin(\omega t - k\xi)\\ n_2 &= n_{\rm cub} - \frac{n^3_{\rm cub}}{2}p_{44}S_6\sin(\omega t - k\xi)\\ n_3 &= n_{\rm cub}, \end{aligned} \qquad (1.6.7.15)$$

thus forming an optical grating of spatial periodicity given by the $k\xi$ term. In gallium arsenide, at a wavelength of light equal to 1.15 µm, $p_{11} = -0.165$, $p_{12} = -0.140$ and $p_{44} = -0.072$. It is convenient to define a figure of merit for acousto-optic materials (Yariv & Yeh, 1983) given by

$$M = \frac{n^6p^2}{dv^3}, \qquad (1.6.7.16)$$

where v is the velocity of the sound wave and d is the density of the solid. For gallium arsenide, d = 5340 kg m^{-3}, and for a sound wave propagating as above v = 5.15 m s^{-1}. At the wavelength λ = 1.15 µm, n = 3.37, and so it is found that M = 104. In practice, figures of merits can range from less than 0.001 up to as high as 4400 in the case of Te, and so the value for gallium arsenide makes it potentially useful as an acousto-optic material for infrared signals.

1.6.8. Glossary

α, β, γ	refractive indices of biaxial indicatrix, $\alpha < \beta < \gamma$
$\hat{\alpha}$	polarizability operator
B_i	ith component of magnetic induction
c	velocity of light
$c_{k\ell mn}$	$k\ell mn$th component of elastic stiffness tensor
$\chi_{ijk\ldots}$	$ijk\ldots$th component of generalized susceptibility
d	density
D_i	ith component of dielectric displacement
Δ	phase difference of light
$\hat{e}_{ijm}$	unit antisymmetric pseudotensor of rank 3
E_i	ith component of electric field
g_{ij}, G_{ij}	ijth component of gyration tensor
$\mathbf{G}$	gyration vector
$\gamma_{ij\ell}$	third-rank optical gyration susceptibility
$\mathbf{H}$	magnetic field intensity
η_{ij}	ijth component of dielectric impermeability tensor
ε_o	permittivity of free space
ε_{ij}	ijth component of dielectric tensor
κ	ellipticity of wave
$\mathbf{k}$	wavevector of light propagating in crystal ($\lvert k\rvert = 2\pi/\lambda$)
λ	wavelength of light
μ_o	vacuum magnetic permeability
n	refractive index of light
$n_\alpha, n_\beta, n_\gamma$	refractive indices for biaxial indicatrix, $n_\alpha < n_\beta < n_\gamma$
n_o	ordinary refractive index
n_e	extraordinary refractive index
Ψ_i	wavefunction of state i
P_i	ith component of electric polarization
$p_{ijk\ell}$	$ijk\ell$th component of elasto-optic (strain-optic) tensor
$\hat{p}$	electric dipole operator
ρ	optical rotatory power
$\pi_{ijk\ell}$	$ijk\ell$th component of linear piezo-optic tensor
r_{ijk}	ijkth component of linear electro-optic tensor
$\hat{s}$	unit vector in the direction of **s**, the wave normal
S_{ij}	ijth component of strain tensor
T_{ij}	ijth component of stress tensor
v	velocity of sound
V	half the angle between optic axes
ω	cyclic frequency
x_i	direction of ith Cartesian axis, i = 1, 2, 3

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