



Raman Crystals

KGW • Ba(NO₃)₂

CRYSTALS FOR STIMULATED RAMAN SCATTERING



EKSMA OPTICS offers crystalline materials – **Barium Nitrate** – Ba(NO₃)₂ and **undoped potassium gadolinium tungstate** KGd(WO₄)₂ or KGW which have attracted much interest for stimulated Raman scattering (SRS). These materials can be used for frequency conversion in lasers for extending the tuning range. SRS in crystals is compatible with current all-solid-state technology and provides a very simple, compact means of frequency conversion.

Ba(NO₃)₂ has a highest Raman gain coef-

ficient. The gain coefficient affects the threshold for Raman laser. However, the thermal lensing is particularly strong in this material. This is indicated by the large value $\partial n/\partial T$ and low thermal conductivity. Thermal effects are significantly smaller in KGW. This along with the high damage threshold make the crystal an excellent candidate for power scaling.

Comparing Ba(NO₃)₂ and KGW for Raman application Ba(NO₃)₂ is more optimal in case of ns and longer pulses, KGW – in case of shorter pulses.

Ba(NO₃)₂ PHYSICAL AND OPTICAL PROPERTIES

Crystal symmetry	cubic, P2 ₁ 3
Transmission range	0.35–1.8 μ m
Density	3.25 g/cm ³
Hardness Mohs	2.5–3
Refractive indices @ 1064 nm	$n = 1.555$
Raman shift	1048 cm ⁻¹
Raman gain, pump 1064 nm	11 cm/GW
Thermal conductivity, W/mK	1.17
$\partial n/\partial T$	-20×10 ⁻⁶ K ⁻¹
Optical Damage Threshold	~ 0.4 GW/cm ²

KGW PHYSICAL AND OPTICAL PROPERTIES

Crystal symmetry	monoclinic, C2/c
Transmission range	0.35–5.5 μ m
Density	7.27 g/cm ³
Hardness Mohs	4-5
Refractive indices @ 1064 nm	$n_o = 2.061$; $n_m = 2.010$; $n_p = 1.982$
Raman shift	901 cm ⁻¹ (p[mm]p)
	768 cm ⁻¹ (p[gg]p)
Raman gain, pump 1064 nm	3.3 cm/GW (901 cm ⁻¹)
	4.4 cm/GW (768 cm ⁻¹)
Thermal conductivity, W/mK	$K_o=2.6$; $K_m=3.8$; $K_c=3.4$
$\partial n/\partial T$	0.4×10^{-6} K ⁻¹
Optical Damage Threshold	> 10 GW/cm ²

Raman wavelengths in KGW crystal (oscillation coefficient 901.5 cm⁻¹) and Ba(NO₃)₂ crystal (oscillation coefficient 1048.6 cm⁻¹) are given in the table below.

Stokes	KGW pumped @ 532 nm	KGW pumped @ 1064 nm	Ba(NO ₃) ₂ pumped @ 532 nm	Ba(NO ₃) ₂ pumped @ 1064 nm	Typical efficiency, %
1 Stoke	558	1177	563	1197	35–70
2 Stoke	588	1316	598	1369	20–40
3 Stoke	621	1494	638	1599	10–15
4 Stoke	658	1726	684	1924	<10
1 Antistoke	507	970	503	957	10–30

STANDARD SPECIFICATIONS

	Ba(NO ₃) ₂	KGW
Surface Quality, scratch & dig (MIL-PRF-13830B)	40-20	10-5
Flatness @ 633 nm	$\lambda/4$	$\lambda/8$
Maximal element dimensions, mm	10×10×100	10×10×80